Winter 2-1896

Volume 5 - Issue 5 - February, 1896

Rose Technic Staff
Rose-Hulman Institute of Technology

THE ROSE TECHNIC.

VOL. V. Terre Haute, Ind., February, 1896. No. 5

THE TECHNIC.

TERMS.

One year, $1.00. Single Copies, 15 Cents.

Issued Monthly at Rose Polytechnic Institute.

Entered at the Post Office, Terre Haute, Ind., as second-class mail matter.

NOTICE TO SUBSCRIBERS.

Hereafter we shall follow the general rule regarding subscriptions, and shall continue sending THE TECHNIC to subscribers until notified to discontinue.

THE date for the final selection of thesis subjects by the members of the Senior class was placed about a month earlier this year than it has been heretofore. The purpose in this, as we understand it, was to give more time for definite preparation; such as the collecting of necessary information and designing of special apparatus for the carrying out of the work selected. There have been quite a number of cases in recent years in which from a simple lack of time students were unable to obtain any results of value from the experiments undertaken as thesis work. If the method of attack adopted at first failed to give the expected results it was then too late to make the changes necessary to perfect the apparatus or process.

Such a state of things is neither encouraging nor profitable. If the work done in preparation of theses is to be of any great value it should be performed with sufficient care and thoroughness to give to the student the satisfaction of something definitely accomplished and an object lesson in the principle so essential in actual business, of carrying anything once undertaken clear through to completion. As a means to such an end it would seem desirable to place the time for choice of subjects still earlier in the school year, even within a few weeks after the opening of the fall term. Then with the line of work settled upon, many of the unavoidable preliminaries such as correspondence, ordering of materials and oftentimes waiting idly for their arrival, reading up on the subject, designing of machines, etc., could be gotten out of the way. Thus when the first "thesis week" rolls around the entire time could be put in to advantage directly upon the work chosen.

* * *

THE time is again drawing near when the annually recurring question, "where shall the State Field Day be held?" must be decided. As ever before the students of Rose stand ready to accept the responsibility of the management of the event should the delegates to the meeting in March see fit to award us the honor. The arguments which have time and again been urged in favor of holding this athletic contest in Terre Haute apply with even greater force than ever before. When to the advantages of a conveniently accessible and admirably fitted place for the performance of the events, and a city of sufficient size and general interest in athletics to support the enterprise financially, are added that of long experience in the management of such affairs backed by a record of many successes, the combination is surely hard to equal. The labor involved in the preparation of all the details of such a meeting and their prompt execution on the final day is no small task as may be imagined. The membership of the Rose athletic association is practically identical with that of the Institute itself and by taking advantage of the old principle that "many hands make light work" the burden is greatly lessened. In this fact may be found much of the secret of the successful meets which have been held here in the past.

Of course we can not and do not wish to overlook the objections which have been and may still be raised against holding the annual meet here. But much of the force with which they were urged in times past has been taken from them. Perhaps the strongest objection was that it gave the institution under whose auspices the meet was held a great advantage in the way of winning the championship. If any further answer to this is required than that of the experience of two years ago at Indianapolis it may be found by considering the elements leading to such a victory. The practice and training necessary for supremacy in any one event is a matter requiring great persistence and determination and extending over months, yes and years. It is unreasonable to suppose that the mere matter of a journey of a few hours should have much weight with the athlete who has shown the required energy in training up to the point where he has any reasonable hope of excelling. And again it is in the nature of things impossible for the athletic team of any college to number much more than a small fraction of the total enrollment, at the highest limit, indeed not many more than the average football team with substitutes. So that the total expense for transportation is no very serious item. As to the value of the stimulus to heroic effort afforded the contending athletes by the enthusiasm of the crowd of fellow students, that is a question for the student of psychology, but we might add that so far as experience here at Rose has shown, distance only serves to intensify the enthusiasm of the student body.

But for fear of the intimation that we are fit subjects for the great Chicago cure we will not urge the claims of the Prairie City too strongly. Nevertheless our friendly invitation to the sister colleges of the state is none the less cordial and should they again see fit to visit us, they may be assured of the very best treatment that it is in our power to give.

THERE has been some talk of the advisability of including Spanish in the Institute courses at least as optional in the place of French. True it is that the language is not of great value as a factor in general education. Its literature does not abound in the ponderous results of intellectual and material research as does the German, nor yet in the works of fiction and those pertaining to the fine arts, with which French is associated. The arguments in favor of the Spanish come rather from the characteristic technical school standpoint of practical utility.

The great expanse of comparatively undeveloped country in our twin continent, united to us by the slender Siamese bond which still resists the herculean efforts made to sever it, has proved a tempting field for the enterprising engineer and is becoming more so year by year. The great interest which the recent Venezuelan flurry excited and the prominence given to all sorts of information concerning the little republic in the newspapers of this country has seemed to direct greater attention to this El Dorado. The significant fact which concerns us here is that throughout almost the entire length and breadth of the continent and even up to our nearer neighbors Mexico and Cuba the prevailing tongue is Spanish. It is not at all unlikely that some of the graduates of the Institute may seek their fortunes in some part of the great south land and to them even a slight knowledge of the language in use there will be of great value.

* * *

SINCE the first reports of the Hertz experiments on electrical vibrations in 1888 nothing has occurred to arouse the scientific world to such a degree of interest as the recently published accounts of the discovery of Prof Röntgen in what has been called "dark light photography." The descriptions published so far have been exasperatingly meagre but enough has been gleaned to show the essential principles, and energetic workers in this country have already obtained very fair results. As is pointed out by C. J. Reed, in the

Electrical World of February 1st, the action or phenomenon is only what might have been predicted from the well known properties of electrical vibrations. This detracts very little however from the striking character of the discovery although, as is frequently the case, it seems to have been made by accident rather than by reasoning from known facts.

The impressions on the photographic plates are not what is ordinarily implied in the term photograph, but are simply shadow pictures or silhouettes. That is, the rays producing them are not focussed, and the object of which the image is desired is placed between the source and the plate on which the impression is made. There appears to be some uncertainty as yet as to just the nature of the vibrations producing the action on the silver salts in the plate. The very short or ultra violet rays which ordinarily give the most vigorous action are readily transmitted through glass, and are obstructed by opaque substances. Hence, they seem to be barred from the question by the very fact which forms the strange feature of the discovery, that is, that the photographs may be taken through a thick pine board, sheets of leather, rubber or other organic substances. The very much longer waves recognized as electro magnetic vibrations, while passing readily through ordinary opaque bodies excepting the metals, do not, it is thought, have any effect upon the silver salts of the plate. The peculiar rays, whatever their nature, are emitted from the negative pole or cathode of a Crooke's tube, through which the discharge from an induction coil is passed. Some attempt has been made to explain the phenomenon on the supposition of fluorescent action at the surface of the sensitive plate, but no very definite theory has been proposed.

We had hoped to be able to give in this issue a report of the experiments which have been in progress in the Electrical Laboratory here for the past week, together with reproductions of negatives obtained, but the delay occasioned by the leaking of some of the tubes, and the preparation of others has made this impossible. The process has already found a very useful application in surgery in locating foreign bodies, such as bullets imbedded in the flesh or bone. Developments in this and other directions will be awaited with much interest.

* * *

THERE have been from time to time numerous complaints made by students in regard to the restrictions put upon the use of the Library. Though not very forcibly expressed they were nevertheless evidence of considerable disatisfaction. Of late, however, there has reached the ears of THE TECHNIC a protest so strong as to leave no doubt of the desire on the part of a large number of the students for certain changes.

In the first place, the hours during which the Library is open are not such as suit the convenience of the majority, when the arrangement of the hour plan is considered. Here must be distinguished the two ways in which the students may make use of it, namely, for purposes of references, such as in collecting notes from a number of authorities bearing upon one particular topic, and on the other hand by the taking out of works for more extended reading. As far as the first case is concerned it is plain that the only time which may be so employed is that not taken up by recitations or practice. Thus it appears that the time of opening the library in the morning, that is at 9 o'clock, leaves very few opportunities for its use in this way before the noon hour. The class most favored in this respect has four hours per week while the Senior class has but a single hour.

As to the second case, that of the taking of books from the Library for private reading, the most convenient time is at the end of an hour of recitation, especially in the evening. Under the present plan of closing at 4 o'clock, it is necessary to secure the desired book before this time and then carry it to shop, laboratory or two or more recitations, unless it be meanwhile deposited for safe keeping in the corridor.

Especial complaint has been made at the late rule of closing the doors during the time when the Librarian is engaged with a recitation. The only reasons that can be conceived of for such a practice are those which might apply to a primary school. Surely it is not necessary here.

As has been expressed before in these columns, we believe that the Library is not by any means used by the students to the extent that it should be, considering not only the immediate value in facts gained, but also that which is perhaps of greater importance, the acquiring of the ability to use all the literature at hand relating to any subject under investigation. From this standpoint it would seem best to offer every encouragement to such use rather than to place restrictions upon it. A change from the present hours to that of from eight in the morning to six in the evening would help matters greatly.

* * *

WE have the pleasure of announcing the election of Mr. J. J. McLellan, of '99, to a position on the staff of THE TECHNIC. As the representative of the paper from the Freshman class, we ask for him the heartiest support from his classmates and other members of the Institute as well.

* * *

ON March 13th, will be held at Indianapolis the regular annual meeting of the Indiana College Press Association. It is to be hoped that this meeting will be better attended than was that of last year.

The list of subjects as they have been assigned for presentation at that time is as follows: "The Purpose of the Literary Department of a College Paper," *Butler Collegian*. "What Should Our Exchange Department Be?" *Franklin Kodak*. "The Practical Newspaper Education Gained From Experience on a College Paper," *The Earlhamite*. "The Mutual Relations Between the College Paper and the Alumni," *DePauw Weekly*. "Should the Editorial Department be General or Local?" *The Wabash*. "What Does a College Owe its Paper?" THE ROSE TECHNIC. Sources of Material for the Local Department; How Obtained," *Purdue Exponent*. "The Financial Basis of a College Paper," *Indiana Student*.

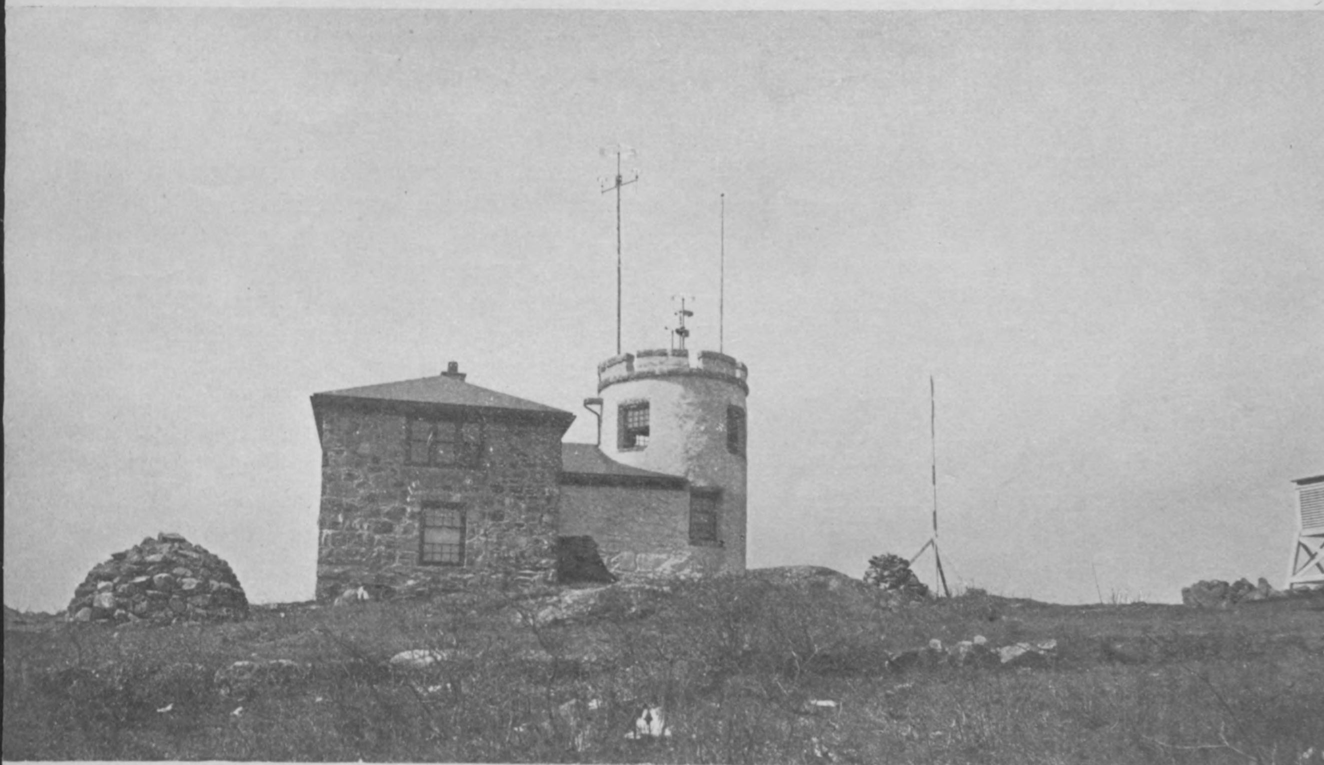
* * *

WE are pleased in being able to present in this issue an article from the pen of Professor Kendrick. The subject which is presented, that of studies as to the position, dimensions and movements of clouds, is of interest to every one. What schoolboy is there that has not many a time when stretched out on his back on the grass, watched with wonder and admiration the majestic towering forms and ceaseless changes of the summer clouds? How far up are they? What are they made of? Where do they come from and where do they go? Such are the questions that puzzle his boyish brain. As he grows older he may find them answered in part, but not by any means as completely as he desired even while making his first observations from his humble station on the lawn. From its intimate connection with that most popular conversational topic, the weather, we come to pride ourselves, the most of us, on our ability to discern the face of the sky. In this connection also very much has been learned of the movements of the air and with it the clouds over extended regions, as is embodied in the now very familiar reports and predictions of the Weather Bureau. But when it comes to the more exact data as to the position and movements of some one particular point in an air current as indicated by a cloud, it is surprising to find how little is definitely known.

Professor Kendrick is enabled to speak from experience on the subject, having been engaged for some time in the work at Blue Hill Observatory. The article will well repay careful reading.

CLOUD STUDIES AT BLUE HILL, MASS.

BY PROFESSOR ARTHUR KENDRICK.



BLUE HILL METEOROLOGICAL OBSERVATORY.

There are comparatively few objects or phenomena, occurring on a large scale, which are so closely and universally observed, and therefore, in a sense, so familiar, and yet their real character so little understood, as the clouds. And this is not true in the case of ignorant people alone, nor of thoughtless persons, nor of those whose thoughts and interests are otherwise absorbed; but it has been, and is yet, to a great extent, true that the physicist and meteorologist even, are obliged to say they do not know, in answer to a large number of questions that naturally arise regarding the formation, dimensions, positions, movements, etc., of the clouds. Not enough reliable and useful data have as yet been accumulated and published to furnish the desired information. To be sure any thoughtful person can learn much in a relative way by careful observation and common sense, but the absolute determination of various important facts, such as heights, velocities, dimensions, and the constancy or variability of these at different times, for clouds of the same appearance require the cöoperation of many observers, distributed widely over the earth, and supplied with facilities for making systematic observations that shall be comparable with one another.

To the meteorologist the clouds are of importance not alone because they are themselves prominent features of the weather, but also because they furnish almost the only indications he can easily get of the movements of the air currents in which they float. Of course ascents in balloons, both free and captive, have yielded, and will doubtless further yield most valuable information; but the expense, uncertainty and risk attendant on that mode of observation are very great checks to the rapid accumulation of the data wanted. Stations at high altitudes, like those of France on the Puy de Dôme (4,800 feet) in Auvergne, on the Pic du Midi (9,440 feet) in the Pyrenees, on the Mont Ventoux (6,250 feet), in Provence, and on the Higoual (5,150 feet) in the Cevennes; like that at the Rochers des Bosses (14,300 feet) on Mt. Blanc, which yields some useful information concerning the weather for two or three summer months only; like that of Austria on the Sonnblick (10,170 feet), the highest permanently occupied observatory in Europe; and like that on El Misti * (19,300 feet), a volcanic peak near Arequipa, in Peru, equiped with a very ingenious piece of apparatus, designed and constructed by Mr. S. P. Fergusson, an observer at the Blue Hill station, recording continuously for three months or more five different features of the weather; stations like these contribute information of great value. But in addition to the objection of expense, there is this disadvantage of considerable moment, namely, that the conditions at these stations are not at all what they are in the free air at the same height and latitude. There is, however, a method that promises well of getting direct observation of the atmospheric conditions at moderate heights, that of flying kites. But clouds are such abundant and such frequently recurring objects of easy observation that it seems natural to turn to this method of investigation of the air currents.

Cloud observations, in this country particularly, have until very recently been fragmentary and relatively few. This fact led the proprietor of Blue Hill Observatory, and the observers there. to devote much of their time and excellent facilities to the accumulation of reliable and useful data concerning the clouds as they occur in that locality. And it may be of interest to mention here that this meteorological observatory † is an entirely private institution, established and maintained by Mr. A. Lawrence Rotch, of Boston, an enthusiastic meteorologist. The hill (635 feet), about ten miles from Boston, is the highest elevation, within ten miles of the coast, between Florida and southern Maine. The station, through the character of its work and equipment, has become recognized at home and abroad as a very important one.

For several years they have made there detailed hourly cloud observations during daylight, using a mirror for determining the direction and apparent relative velocity of the cloud movements.

But a moment's thought will make it plain to the reader that if two clouds at different heights, have the same actual velocity, the lower one will appear to move more rapidly, or in other words, the velocity, measured in angular measure, of the lower is greater than of the upper. So it is evident that a person remaining at one place cannot get from observations of angle any information concerning the actual cloud heights and velocities. A base line of reference is necessary, as well as angular measurements. Cloud shadows moving over the ground give an easy means of rightly measuring velocity, but give no information concerning height, though with a simultaneous angular measurement this can be found. But infrequency and obvious uncertainties and inaccuracies make this method of slight account. A known base line and accurate simultaneous angular measurements of a given point of a cloud, taken at each end of the base line, make possible a simple trigonometrical calculation of its coördinates, and similar successive observations and calculations, for the same point at known intervals of time, give easily the actual velocity of that point. It was this method that was adopted at Blue Hill.

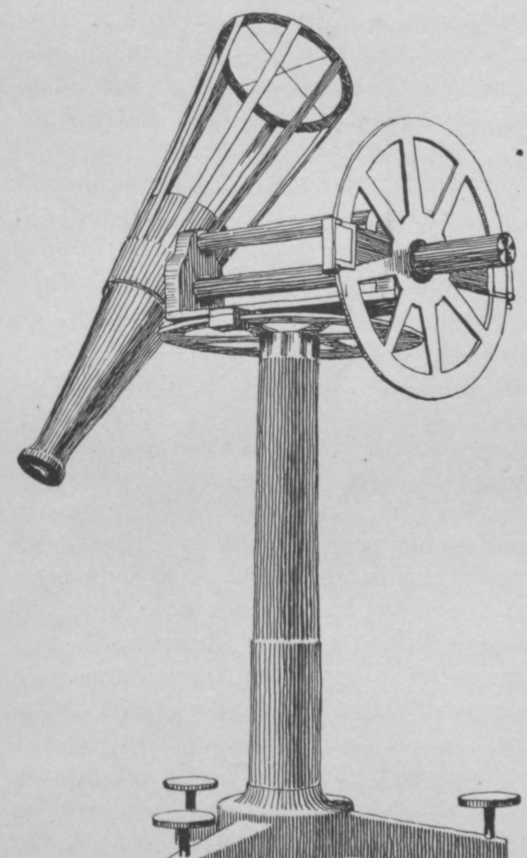
The accompanying cut shows very nicely the theodolite that is used. As appears there the line of collimnation is determined by the intersection of the cross wires at the farther end and by the eye piece at the near end. It is not a telescope, but a line mounted upon horizontal and vertical axes, so that the direction of this line of sight is given in azimuth and altitude angles. A theodolite securely mounted and carefully adjusted at each end

* This station was established by the Astronomical Observatory of Harvard College, and is maintained by it from their neighboring observatory in Arequipa.

† Through the kindness of Mr. Rotch we are able to give the cut of this observatory, which appears above.

of the base line, about three-fourths of a mile long, together with a telephone line connecting the stations, completes the outfit.

Practical difficulties arise to complicate the theoretically simple problem, many of which are easily anticipated. Chief among them are these: in a limited time, and by telephone conversation



— THEODOLITE —
USED IN CLOUD OBSERVATIONS

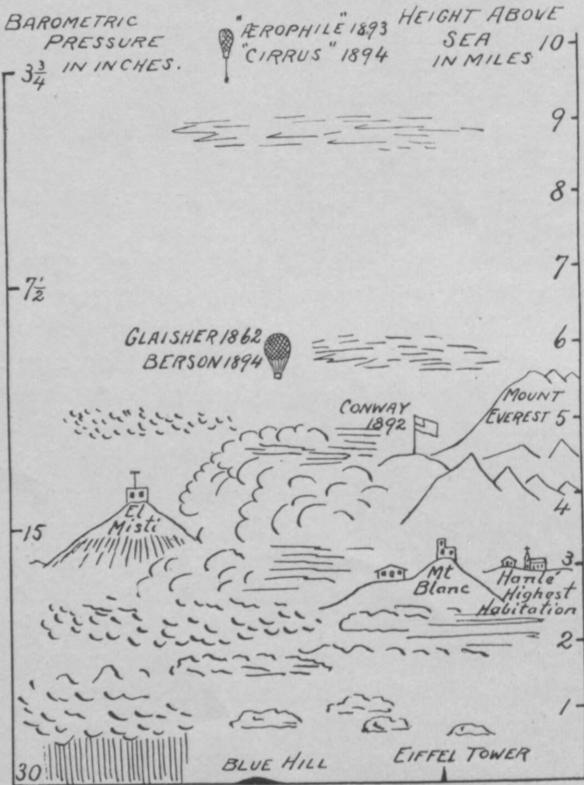
only, it is not certain in most cases that the two observers are talking about and hence making observations on exactly the same point; and then the real difficulty exists that the same actual point of a cloud does not appear the same at the two stations, that is, in general one observer will see a configuration of the profile that will appear slightly different for the other. This is due to parallax, and is most troublesome with the more rounded cloud forms. But in either case the lines of sight, as we may call them, the prolongations of the lines of collimation of the theodolites, do not actually intersect each other, and hence do not form with each other and the base line a triangle. So an assumption becomes necessary, and that of Drs. Ekholm and Hagström, of Upsala, Sweden, was adopted. It is this: that the middle point of the perpendicular joining the two lines of sight is in the long run the best point to calculate for the point observed.

A very considerable amount of data has been accumulated and reduced by this method, and while only a beginning may be said to have been made as yet, a number of interesting facts are brought out in the results of the observations already made. To speak of these intelligibly it is necessary to come to some understanding regarding the names of clouds. Mr. Clayton, the observer who is conducting the investigations there, and who is recognized as good authority on cloud classification, suggests a very natural division into three general classes, the stratus type or "sheet clouds," the cirro-cumulus or "flock clouds," and the cumulus or "piled clouds." These names carry to a considerable extent their own explanation; for the reader will readily recall that the spreading out into apparently flat, thin sheets is characteristic of many clouds, that the massing together of little piles, like flocks of birds or sheep, is a decided feature of others, and that the massive, piled-up, snow-bank form is the prevalent summer cloud.

It has been well known that that the cirrus cloud, usually a stratus or sheet cloud, and ordinarily recognized and distinguished from other stratus forms by its light, feathery, frosty appearance, is the highest of all, for it is evidently made up of ice particles, as indicated by the halos, etc., that it forms around the sun and moon. This cloud also assumes frequently the cirro-cumulus form. The Blue Hill measurements show that in that vicinity in summer these cirrus clouds average about 31,900 feet, or very nearly 6 miles above the sea level.

Referring to the accompanying sketch, designed to show roughly the relative heights of a few elevated peaks, famous balloon ascents, and characteristic cloud heights, together with the atmospheric pressure measured in inches of barometric column, it will be seen that the height of these clouds is just about that which was reached twice by men in balloons. Their reports confirm the

— COMPARATIVE ALTITUDES. —



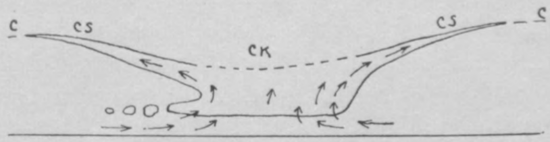
statement as to the constitution of these upper clouds, and confirm also the expectation as to the temperature to be found there, for their thermometers recorded—54° Fahrenheit. The maximum height of these clouds yet measured was about $9\frac{1}{4}$ miles, very nearly that to which two balloons, carrying only self-registering apparatus, ascended from Berlin, and it is interesting to note that the accurate recording thermometer of one of them, the "Cirrus," recorded—64° F. It is the cirro-cumulus form that often groups into the mottled or speckled sheets sometimes called mackerel clouds. This *appearance*, the divisions into rows and columns is not confined, however, to the high cirro-cumulus just spoken of, but is found, usually in rather denser masses, at successive lower levels. Various stratus forms also occur at corresponding lower levels. These varied forms are as a rule definitely distinguishable by the expert, and named more or less characteristically, as strato-cirrus, alto-stratus, alto-cumulus, etc., but it is hardly possible to describe the varied forms in an article so brief as this so that the reader will understand clearly what is meant, and so perhaps it will be more to the point to say comprehensively that these occur in three or four fairly well defined levels between the heights of 2.6 miles and 6 miles. Then there are the lower stratus clouds which shut us more closely in, varying from a ground cloud, or fog, to a heavy, solid sheet at the height of about 1 mile. In a stormy sky the clouds are usually less than $\frac{1}{2}$, or even a $\frac{1}{4}$ of a mile above us.

Clouds of the pure cumulus type are perhaps the most fascinating to many of us who are interested in watching them for their beauty and grandeur alone. The bases of these piles of snowy vapor are nearly always very flat, and the reader will remember that nearly all the clouds of that kind in sight at one time seem to be approximately at the same level. This is also true as a rule for most kinds of clouds, though the levels at which they are found at any particular time may be slowly changing. The bases of these cumulus clouds are, in summer, at a height of about 1 mile, though as they gather into showers the lower surfaces are usually much nearer the ground than that. As every one has noticed, these clouds frequently pile up into tremendous masses, and it is interesting to find out what actual measurement has determined as to the heights reached. Mr. Clayton finds that the average altitude of the tops of these masses, in the accumulations which ordinarily cause showers, is about 5.1 miles, or in other words, these shower clouds are most frequently about 4 miles thick. Cumulus of this form occur practically only in warm seasons.

There is a very decided difference between the heights of the clouds in summer and in winter. The high cirrus, given above as six miles in summer, are found to be about five miles in winter, the cirro-cumulus coming down to about 4.5 miles, and the other forms are found correspondingly lower in winter than in summer, though not in exactly the same ratio of change.

The facts learned concerning the velocities of the clouds are also interesting. The average movement of the highest, the cirrus, is about 60 miles an hour in summer. The maximum observed was about 130 miles an hour. In winter, however, the average velocity was found to be about 100 miles per hour, and the maximum observed, over 200 miles per hour. These are the fastest clouds. The lower ones have, as a rule, smaller velocities, but the same very great relative difference between the summer and winter movements is found to occur in case of these also. Thus the lower cumulus, found to move at about nineteen miles per hour in summer, attain about twenty-seven miles per hour in winter. It is found that in general the "flock-clouds" move considerably faster than the "sheet-clouds" of corresponding levels. A comparison of measurements made at Blue Hill and those made in England and Sweden, seem to indicate that in these latitudes nine miles is about the limit in height of cloud formation. The average velocity appears to be greater over Blue Hill than over most parts of Europe where measurements have been made.

Mr. Clayton has selected and arranged a considerable amount of his data with a view of getting information concerning the body of clouds in a storm area. The accompanying sketch shows approximately how the clouds in relative height succeed each other as the ordinary cyclonic storm passes over Blue Hill. The sketch represents a vertical section of the storm moving over the station so that the right of the figure is the front of the storm. C means cirrus, C S, cirro stratus; C K, cirro-cumulus, the lower clouds forming the body of the storm are more or less continuous



and dense, and would perhaps best be called stratus, while those lower detached clouds in the rear of the storm are strato-cumulus; the arrows show the direction of air currents as indicated by wind vanes at the ground surface, and the average direction of motion of the clouds above. Very positive information is not at hand concerning the upper surface of the cloud sheet, but the dotted line represents it, as he thinks he is justified in conceiving it, as dish-shaped.

A further accumulation of this kind of data, and, more important still, such data at well chosen points scattered over the country, will yield informarion concerning the movement of the upper air of the utmost value.

THE HISTORY OF SUBMARINE TELEGRAPHY.

AN ABSTRACT OF THE LECTURE DELIVERED BEFORE THE SENIOR AND JUNIOR CLASSES BY PROFESSOR GRAY.

The History of Submarine Telegraphy practically begins with the attempt of an English company to lay a cable between Dover and Calais in 1850. The cable was an unprotected one, being simply insulated with gutta percha, and was only laid to save a concession that France had made to the company.

Messages were successfully transmitted but for only one day. In the following year a second cable was attempted over nearly the same route. The construction was similar to that of the cables of the present day, the cable consisting of four wires, each insulated with gutta percha, the whole covered with a serving of hemp yarn and armored with iron wires. The length laid was twenty-five miles, weight seven tons to the mile, and the total cost was $45,000.

A number of cable enterprises were projected about this time, Great Britain being the centre of them. A cable was laid from England to Ireland by a private company, but was of too light material and was a failure. An attempt was made to connect England with the Netherland, by a system of light cables, each being laid separately, and the whole brought together at the shore end. These were also too light and were replaced after a few years. At this time there was no protection from fishermen, who would catch the cable by hooking with their anchors and then cut it to free themselves. International laws have since been passed which put a stop to these depredations. After this followed in rapid succession cables from England to other parts of the continent and from Denmark to Iceland and Sweden. Then came a series of cables in the Mediterranean sea, together with some which were used in the Crimean war, most of which however had a short life.

In the year 1854 the first cable company in the United States was formed, Cyrus Field being one of the most influential members. The object was to connect New Foundland, Nova Scotia and Prince Edwards Island with the main land at Portland, Me.

The first Atlantic enterprise was started soon after this. All the experience gained in signalling through long distances was heretofore derived by joining up several short cables and consequently there was no actual knowledge of the deep sea conditions.

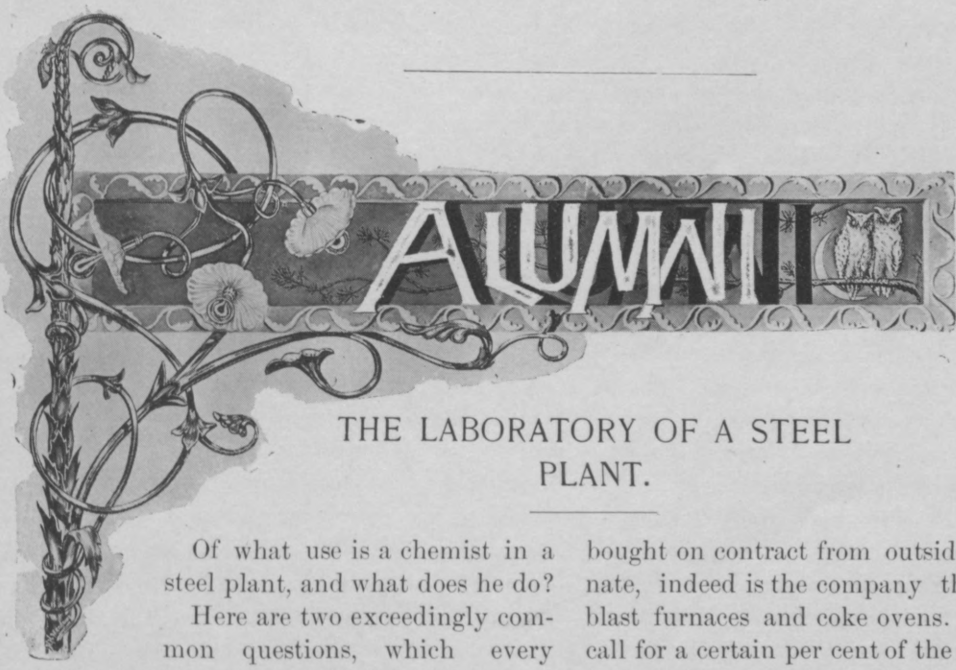
It was at this time that Sir W. Thomson now known as Lord Kelvin became prominently known in telegraphy. Papers were read by him on the flexibility of cables in which he proposed to divide the conductor into a number of small strands, and on the theory of signalling through long cables.

A meeting was held in Glasgow in 1857, a company formed, and 350 shares at $5,000 each were taken up in one night. All assistance possible was given by both England and the United States. Three warships were furnished by each country for the project and in 1858 the first Atlantic cable was laid between Valentia, Ireland, and New Foundland, a distance of 1,800 miles.

After working successfully for a month it gave out and proved a loss of $3,500,000. This stopped the Atlantic enterprise for a number of years and a considerable number of the longer cables which were laid during the next few years were either total failures or worked for but a short time. Perhaps the most serious of these losses was the cable from Suez, through the Red Sea to Kurackee, in India. Up to this time over 5,000 miles of the cables which had been laid proved useless. Then a number of successful cables followed, notably the one from Malta to Alexandria and that through the Persian Gulf, in deep water. This demonstrated that there was no reason why an Atlantic cable should not be successful, especially as the Atlantic posesses a soft bottom from New Foundland to England. In 1864 the Great Eastern laid a cable, armored with Bessemer steel, covered with hemp and soaked in tar, almost to New Foundland successfully. There it was lost, a number of attempts were made to pick it up but they were all failures.

In 1866 another cable was laid successfully and the first recovered and spliced.

From this date the art of cable manufacture and laying has progressed steadily. In some tropical seas, such as the Red Sea, the gutta percha covering has been attacked by a small marine animal called the teredo which bores right through to the copper. To avoid this difficulty cables were manufactured with a continuous band of copper ribbon over the gutta percha which did away with the difficulty. Several cables are now in successful operation in the Red Sea, and to various parts of Asia and Australia. If Japan were connected with the United States there would be a girdle of cables around the world. At the end of 1866 about 30,000 miles of cable had been laid, with a total value of from $28,000,000 to $30,-000,000. Of this amount nearly $15,000,000 was lost in unsuccessful attempts. In the years 1869–70 alone, some 15,000 miles were laid. In 1875 the first direct cable was laid between England and the United States was attempted. At present there are fifteen, ten or eleven of which are in working condition.



THE LABORATORY OF A STEEL PLANT.

Of what use is a chemist in a steel plant, and what does he do? Here are two exceedingly common questions, which every chemist in this line meets with, and if answered fully would take much more space than one would imagine. Every extensive steel company has, as one of its most important departments, a chemical laboratory, and the head chemist of the works is a very important personage. In the manufacture of Bessemer steel many different substances are used, and especially if a certain sort of steel is desired. But pig-iron, coke, limestone, ferro-manganese, spiegel-eisen and scrap iron are necessary in any case and with these substances the chemist does most of his work. With the exception of a few plants these articles are bought on contract from outside firms and fortunate, indeed is the company that owns its own blast furnaces and coke ovens. These contracts call for a certain per cent of the substance wanted in each case and are usually accompanied by the analysis made by their own chemist. The first thing done when the company receives the shipments is to weigh them and then sample them and send this sample to the laboratory and here the chemists commence their work. This work must be done rapidly and carefully, as the cars are never unloaded until the result of the analysis is known. Of course the limestone and coke may be unloaded, as it is rare that they do not come up to the standard. But the pig-iron, manganese, etc., are never unloaded until the report is made out. The importance of this rule is easily shown. Steel must not contain a high per cent of phosphorus and sulphur or it will become red short or cold short, as the case may be; that is, brittle when hot or when cold. The phosphorus and sulphur in the pig iron cannot be eliminated when the steel is made, for, on the contrary, the per cents increase from the iron to the steel. So a certain kind of pig-iron must be made and this is known as Bessemer iron, to distinguish it from foundry iron or mill iron. This iron is made purposely low in these two dangerous elements and it is the business of the chemist to see that it is below the limit, which is .05 % in sulphur and .10 % in phosphorus. If the iron is found to be over limit a duplicate analysis is made and if this also shows it to be high then the iron is shipped back to the furnace. Now it is very expensive to the furnace people to receive this iron back and they, in turn, employ chemists, whose business it is to see that no iron is shipped that is over limit. But occasionally the furnace has a cast which is very little over limit and rather than recast it they will pile the car up until nearly full and then cover over with good iron. Of course, it is a fraud, and if detected causes trouble, and it is frequently found out. The sample clerk has istructions to burrow down in the car and select a pig and if he has time does so, but when there are a great many cars coming in he will usually take the first pig he comes across. This pig is broken in two by dropping it on the rail and taken to the sample room, where a drilling is made in the fresh broken surface. This sample is then sent to the laboratory and is analyzed for silicon, sulphur, phosphorus and manganese. One man hunts for silicon, another for sulphur and still another for phosphorus, and so on. The analyses are made in lots of twenty, if enough cars are in to do so. The silicon man will take twenty samples and weigh out his iron, then he passes them to the sulphur man and then they go to the phosphorus man. It takes about two hours to run twenty silicons, one and one-half hours for twenty sulphurs and about five hours for twenty of phosphorus. An average of from sixty to sixty-five cars of pig-iron is received a day and this makes 60 to 65 silicons and sulphurs and about 16 phosphorus, as an average of one analysis to four cars received is made in this last element. Every tenth car is tested for manganese, that is, every tenth car from the same firm. Now, if the iron is up to standard the report is made and the cars unloaded in bins numbered from one up. It has been found that the heat which keeps the metal in the converter in a molten state comes mainly from the oxidation of the silicon in the iron and that a certain per cent of silicon answers better than a higher or lower per cent. This is a little below 2 per cent and so it is the aim of the cupola man to have his charge of iron contain as near as possible to this per cent. But the steel company buys from different furnaces and these furnaces furnish irons which vary in silicon. One furnace cannot furnish enough iron to keep the mill running, and perhaps it has contracts with several mills. A blast furnace makes about 200 tons to a cast and as the Ohio Steel Company can make 1,000 tons of steel per day it takes several furnaces to supply the demand. One furnace makes iron having less than 1 per cent, silicon in it, another, 1.5 per cent, another, 1.5 to 2 per cent, and on up to about 4 per cent. So these different pig-irons are placed in their proper bins and when a charge is made for the converters, it is selected from the different bins in order to make the correct per cent. Now so far as this article has gone it shows how one particular substance is treated and the amount of work the chemists do on it. Of the other articles it can be said that about the same work is gone through, only not so much, as they are not shipped in so freely. With regard to the ferro-manganese, however, it will not be amiss to describe it. Imagine a black substance, coming in large lumps, and extremely hard, and woe to the man who has to grind it. It runs about 81 per cent manganese, 2 to 3 per cent phosphorus and about 1 to 3 per cent silicon and is tested for these three elements. This manganese is put in the converter after the blast is shut off, in order to combine with any oxygen, which might be present in the molten steel. This oxygen is present as oxide of iron and is held in suspension in the metal. The manganese combines as MnO, and passes off together with other gases in the mass. When the steel is ready to be cast into ingots a small ladle full is taken out as a sample and drillings taken from it. This is sent to the laboratory and tested for silicon, phosphorus, sulphur and carbon. The ingots are never rolled until the amount of carbon is known and then the steel is recorded as to the per cent of carbon. High carbon makes hard steel while that low in carbon is known as soft steel and the high carbon steel always contains more silicon. Now the chemist is about through with the part he plays and if no special work comes in he is fortunate. He is kept busy all the time, no chairs are allowed in the laboratory, and he has no dinner hour. But with all this, he has a chance to learn a great deal about steel and methods in analysis and his hope ever is to some day become a head chemist of a steel plant.

Elmer Brown, '94.

THE ROSE TECH' CLUB, OF CHICAGO.

This club, the organization of which was chronicled in the last issue of this paper, is giving positive evidence of its vitality, at least so far as the ability to dispose of a good dinner is concerned. The progress of the club will be watched with some interest as being the first of its kind among the alumni of Rose. Subjoined we give some extracts from the minutes of the second meeting, February 2, 1896:

Club met at the Monroe Restaurant, at 2 p. m., and enjoyed a most excellent dinner, the following members being present:

Putnam, '86,	Condron, '90,
Menden, '91,	Putnam, '92,
McCulloch, '94,	Crowe, '95,
McTaggart, '95,	Catlin, '91,
Leighty, '91.	Mills, '91,
Buntin, '92,	Coleman, '93,
Hebb, '95,	Becker, '95.

After discussing an elaborate menu, the meeting was called to order by the president, Mr. H. S. Putnam, '86.

The minutes of the last meeting were read and approved. It was stated that these had already appeared in The Technic, and were favorably commented upon by the editor of that paper. Also that the recommendation that the term "Rose Tech." be adopted by the students and alumni was favorably looked upon in the Institute.

The report of the entertainment committee was happily stated by the president, as chairman of that committee, to have been already laid before the club by the waiters.

The report of the committee appointed to invite the class of '96 to Chicago, was one of progress, and consisted of reading the correspondence between Mr. Mills and President C. L. Mees, of the Rose Tech'. The letter of Dr. Mees was ordered filed and the committee was instructed to continue its work and report at the next meeting.

On motion of Mr. Menden, seconded by Mr. Leighty, it was voted that an initiation fee of fifty (50) cents be charged to all members admitted to the club.

On motion of Mr. Condron, seconded by Mr. Leighty, it was voted that the president appoint a committee of three members to prepare a concise set of rules to govern the organization and business of the club; the same to be presented at the next meeting.

On motion of Mr. Mills, seconded by Mr. Catlin, it was voted that the third meeting of the club be held on the first Saturday or third Monday in March, as may be found most convenient by the entertainment committee.

At 5 p. m. the club adjourned, after having unanimously voted their thanks to the entertainment committee for the fine entertainment furnished.

ALUMNI NOTES.

"Prof. and Mrs. Henry C. Smith desire your presence at the marriage of their daughter, Fanny Eyer, to Fred F. Hildreth, Thursday evening, February 20th, at 6:30 o'clock, College chapel, Napierville, Ill." The happy couple will be at home in Terre Haute after March 3d. We think Hildreth ought to give us an article on the strength of this, but even if he doesn't, we extend the sincerest wishes and congratulations.

Johonnott, '93, and Mendenhall, '94, are at Johns-Hopkins University; the former writes that they have been working on spectrum analysis, and that they have had the use of the spectrometer that Louis Bell used in making his absolute measurements of wave length, in their work on the subject.

It is rumored that Morton C. Andrews, '94, is contemplating matrimony. Whether he and Hildreth are starting a matrimonial agency or not, is not stated, but things are beginning to look suspicious.

M. C. Andrews, '94, has been admitted as a Junior Member of the American Society of Civil Engineers.

The announcement is made of the engagement of Mr. Charles Sames, '86, of Rockford, Ill., to Miss Lida O. Falkenburgh, of East Orange, N. J. THE TECHNIC extends the heartiest of congratulations.

Rice, '93, is with the Metropolitan Telephone Co., of New York. His address is 169 Congress street, Brooklyn, N. Y. Collett, '90, and Decker, ex-'90 (?), are also with the Metropolitan Co.

Shover, '90, Wales, '91, and Brown, '94, are all with the Ohio Steel Co., of Youngstown.

J. C. Young, '92, is manager of the People's Electric Light Co., at Davenport, Ia.

Wiggins,' 95, and Buckner Speed, '94, were in town recently.

THE OLYMPIC GAMES.

The athletic contests to be held in Athens in April next, which are attracting such widespread notice, promise to be unusually interesting and novel, as the intention is to revive as nearly as possible the games which made Greece famous in ancient times.

However, the contestants will not be confined to the Grecians alone, as there will be present athletes from France, England, Italy, Germany, Russia, Turkey and the United States. The prizes bestowed upon the winners in ancient times were the laurel wreaths with which artists are fond of crowning their paintings and statues of Greek heroes. In the coming contests these wreaths will be of silver, and King George of Greece will bestow them in person.

The Greek government has made a large appropriation to meet the expenses of the affair, and this has been greatly increased by private subscriptions. An immense stadium is to be erected with a seating capacity of one hundred thousand, and its sides will be fitted with marble as in ancient times.

The following will give some idea of the general program of the games:

Athletic Sports.—Foot races, jumping, weight throwing and quoit throwing.

Gymnastics.—Individual and collective combats, fencing and wrestling, assaults with sword and sabre.

Rifle Shooting.—At a mark, different distances, on a field near Athens.

Naval Sports.—Yachting and rowing races in the Bay of Phalerum.

Natation.—Swimming races, polo matches, foot ball, all in the same waters.

Divers Contests.—Bicycle races, tennis, cricket and golf matches.

In addition to this there will be dramatic and musical exhibitions, thereby including educational features in an otherwise spectacular program.

The occasion of the revival of these contests is the celebration of the seventy-fifth anniversary of Greek independence, but if this first attempt should prove successful, they will be repeated every four years.

DE PAUW AND ATHLETICS.

"DePauw has received an invitation to form an athletic league with Purdue and other institutions. This is a move in the right direction. We believe if a league could be formed consisting of Purdue, University of Illinois, DePauw and some other good institution, the cause of athletics would prosper in this section of the country. Purdue and DePauw, of the Indiana Colleges, have always stood for better athletics, *more honorable* and *just dealings* with each other. Now since DePauw has a chance to enter a league which *means something*, it shouldn't go by unheeded."

The above clipping, minus the italics appeared in a recent issue of the *DePauw Weekly*, and the the first emotion experienced by us upon its perusal was one of intense amusement, as it called to mind an affair that occurred somewhat later than this time last year, in which DePauw presented us with a touching example of the kind of "honorable and just dealing" for which she so modestly claims to stand for.

We agree with DePauw that the formation of an athletic league "with Purdue and other institutions" is a move in the right direction and we would heartily endorse all efforts tending to such a consummation. We also concur with the *Weekly* in the opinion that it would cause athletics to prosper in this section of the country, *provided*, (and there would be the difficulty) the members of such a league would in truth stand for the honorable and just dealings of which our esteemed contemporary speaks, and of which we regret to say DePauw has furnished anything but a shining example.

The paragraph goes on to say that "Purdue and DePauw, of the Indiana college, have always stood for better athletics, etc." It is this "we two and no more" spirit, this entire exclusion of all other Indiana colleges from any such claims as one put forth for the above two, that presents the graver aspect of the question, and causes us to take up the cudgel in our own defense and vindication as well as of the other colleges included in thisimplied charge. In the opinion of our esteemed contemporary Rose no doubt forfeited her claim as an advocate for "better athletics, more honorable and just dealings," and the rest, when she opposed DePauw, last spring in her base attempt so throw Butler out of the I. I. C. A. A. because the latter had been guilty of an act of inconsideration toward the former in a football game the year previous.

Again quoting, "Now since DePauw has a chance to enter a league which means something, etc." The sublime egotism of this passage is overpowering. Apparently the present existing state league, of which DePauw was *formerly* a member, has been entirely objectless, has never been productive of any good.

The past record of the I. I. C. A. A. speaks sufficiently in defense of this point. All the athletic enthusiasm of Indiana colleges for the past six years has been due entirely to the existence of this league and had DePauw, in truth, stood for the purity in dealings to which she lays claims, no doubt that league would have been on firmer basis to-day than at any time in its history.

We reget that we have been obliged to resurrect old issues as we have no desire whatever to revive the unpleasant discussion of last year, but we felt constrained to say this much in defense of ourselves and the other Indiana colleges which have come in for a share of our contemporary's disdain.

Note.—Since the foregoing has been put in type we have learned as stated elsewhere of the action of DePauw's delegation to the base ball meeting on Saturday the 15th at which time the desire was expressed by DePauw, to reconsider their hasty action of last spring and recall their resignation from the state association, which in fact has never been officially accepted.

We are pleased to note that the sentiment implied by the *Weekly* with regard the Indiana Association is not that of the University as a whole.

PROGRESS ON THE GYM.

The gymnasium building has reached a point where it is possible to form some adequate idea of its size and appearance. An exterior view does not show this so well, as its proximity to the academic building causes it to appear relatively small, but upon entering one is surprised to find it apparently much larger than it outwardly appears.

Although the unfavorable weather has retarded the progress a great deal, yet the building will soon have reached the point where weather changes will not interfere with its further progress, as it will shortly be entirely under roof. This being accomplished, the work on the interior will be pushed through as rapidly as possible, and if no unforeseen circumstances hinder, the building will probably be ready for equipment within the next three weeks.

The committee has been corresponding for some time past for the purpose of getting prices and making estimates on the probable cost of the more necessary apparatus, and their expectation at present is to place their orders within the next week.

Only about 65 per cent. of the subscriptions have been paid, up to date, and inasmuch as these subscriptions fell due on the 1st of January, it is highly desirable that the remaining promissory notes on hand be taken up as soon as possible. The percentage of unpaid subscriptions is entirely too large considering the length of time they have been overdue, and we must urge upon those who were kind enough to guarantee their assistance, to make good their promises at the earliest possible date.

BASEBALL FOR '96.

A special meeting of the I. I. C. A. A. was called at Greencastle on Saturday, February 15th, for the purpose of making a baseball schedule, resulting in the arrangement of the following:

April 18—Purdue vs. Butler at Indianapolis.
April 25—Purdue vs. R. P. I. at LaFayette.
April 27—DePauw vs. Butler at Greencastle.
May 2—DePauw vs. Purdue at Greencastle.
May 2—Butler vs. Wabash at Crawfordsville.
May 9—R. P. I. vs. Wabash at Terre Haute.
May 23—R. P. I. vs. DePauw at Greencastle.
May 30—R. P. I. vs. Butler at Terre Haute.
May 30—Purdue vs. Wabash at LaFayette.

Wabash and DePauw will decide later upon a date for their game.

I. U. now has negotiations pending for games outside of the state and for that reason refused to enter the schedule for fear of conflicting dates, however they expressed a desire to play other Indiana colleges provided arrangements could be made later on. They have arranged already with Butler for a game at Bloomington on April 11th, and with DePauw at Greencastle on May 9th.

The State Normal was reported as having no athletic association this year, consequently will not be on the schedule. Earlham, as heretofore, will not play baseball.

DePauw expressed themselves as desirous of remaining in the state association, and will at the annual meeting on March 13th withdraw their resignation, which was tendered at the meeting last year, attributing the whole matter as a mistake in the way of hurried action on the part of their, at that time, football manager, Mr. Church.

Purdue requested the delegates to consider that institution an applicant for entertaining and managing the State Field Meet. The place of this meeting and date of same will be decided upon on March 13th, the time of the annual meeting of the State Association.

NOTES AND CLIPPINGS.

Cornell, Columbia, Pennsylvania and Harvard will row a four-mile quadrangular race in June of this year. Cornell had agreements to row with Pennsylvania and Columbia, and also with Harvard, and at her suggestion and through her efforts, the two races were merged into one. The course has not yet been selected.

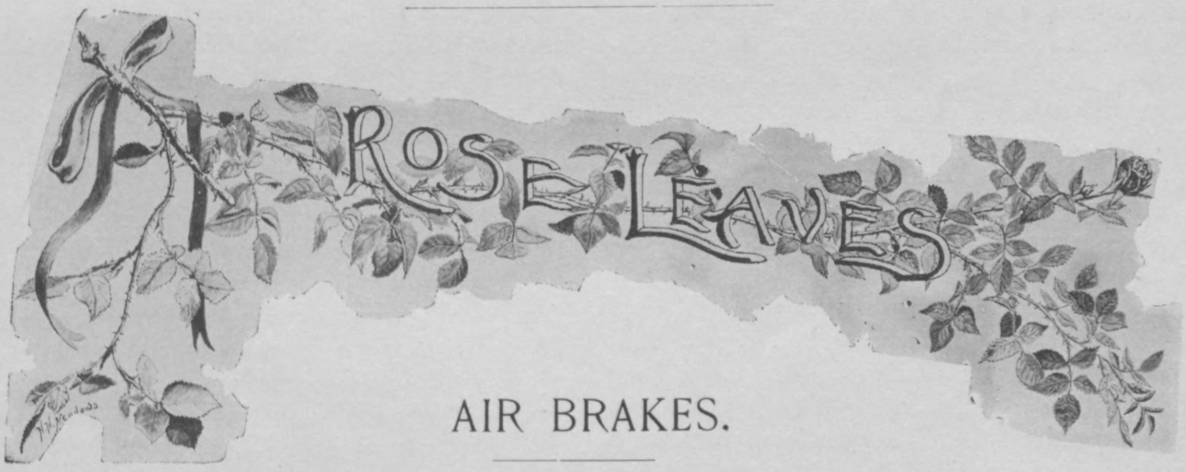
The Harvard football management has arranged for a series of seven fortnightly talks on football, to be delivered by prominent football authorities. Only football players, actual and prospective, will be allowed the privilege of attending these lectures.

A large number of U. of P. last year's ball players have been debarred from playing this season, as it was found upon investigation that they had been guilty of playing on "summer nines," and otherwise violating the amateur rule of that college. Only three of the old team remain eligible for the '96 team.

The University of Chicago base ball team will go east this season, leaving on May 20th. They have arranged for games with Cornell, Harvard, Yale, Princeton and Pennsylvania.

There is a called meeting of the I. I. C. A. A. at Greencastle on Saturday, February 15th, for the purpose of arranging the Indiana Inter-Collegiate schedule for '96.

The University of Michigan recently advertised for bids for the erection of a handsome and extensive Woman's Gymnasium.



AIR BRAKES.

BY R. M. NEWBOLD, '97.

When railroads were in their infancy the question of brakes was not of much importance. There were some very crude forms of brakes in use, the most common form being a hand brake on the engine, which could be worked by the engineer, and there were also brakes on the cars usually worked by a lever on the side of the car on which the brakeman stepped when he wished to apply them and his weight put them on. These old-fashioned contrivances gradually gave way to an improved hand brake somewhat similar to the hand brake found now on the modern freight car.

The weight of all classes of rolling stock, however, kept on a steady increase, while the brake question remained stationary. Accidents were occurring continually which showed too plainly that if some form of power brake capable of being worked by the engineer and applied to the whole train had been used they could have been avoided.

During the period between 1860 and 1870 America became a reproach among nations for the frequency and disastrous nature of its railroad accidents. All because high speed was attempted without adequate braking power when something turned up that required a quick stop. To-day fewer railroad travelers in America lose their lives by accidents, beyond their own control, than the travelers in any other country. This change has been brought almost entirely by the adoption of the Westinghouse air brake.

In the year 1873 the brake question became very prominent and the following brakes came out: "Clark & Webb's chain brake," Smith's vacuum brake," "Westinghouse vacuum brake," and the "Westinghouse air brake." A brief description of the "Clark & Webb brake" might be interesting as it was a brake which utilized the momentum of the train to stop it. A friction pulley fixed to the axle of the car revolved with the axle. A loose pulley to which a drum was attached was suspended from the frame work of the car. Connected to the drum was a chain extending underneath the cars and attached to levers actuating the brake beams. To apply the brake, a lever in the car was lowered, this brought the two friction pulleys together. The revolving pulley made the loose pulley revolve, and turning the drum wound the chain up and pulled the brake on. As soon as the brake was up tight the loose pulley stopped turning but was held tight by the axle pulley until the train stopped. This form of brake was all right as long as nothing happened to the gear, but anything happening to it rendered it useless. The question went through various phases until 1873, and the result is that the automatic vacuum, as used in England, and the Westinghouse here, hold the field. The automatic vacuum brake is a comparatively simple one. To keep the brake released a vacuum must be kept in the brake cylinder and train pipe.

To keep this vaccuum up there is what is called an ejector on the engine, which works somewhat like an injector. There is also a small ejector inside the big one to keep the vacuum while the train is running. Surrounding the brake cylinder is an auxiliary reservoir which is directly in communication with the brake cylinder by means of a hole in the top of the brake cylinder. The train pipe is in direct communication with the under side of the brake cylinder. The auxiliary reservoir and the train pipe have communication through a valve which is a perfect sphere. If a vacuum is maintained in the train pipe this ball valve floats away from its seat and allows a vacuum to be created in the auxiliary reservoir and the brake cylinder. If the vacuum be destroyed in the train pipe by the engineer letting air in, the ball ceases to be in equilibrium and floating up against its seat, communication between the auxiliary reservoir and the train pipe ceases, and vacuum being kept in the auxiliary, and the auxiliary being in communication with the upper side of the brake piston, the piston is drawn in pulling on the brakes. To release the brakes the vacuum must be re-created.

In England 96 per cent. of the carriages have the automatic brake. 38,776 carriages have automatic vacuum, and 19,049 Westinghouse; thus England has two forms of brake in general use, and a great many of the roads that interchange traffic have to put both forms on their vehicles, so it is fortunate the Westinghouse is practically the only brake used here, as a great deal of complication has been avoided. A brake system should fulfill the following requirements:

1. It should be instantaneous in its action and apply itself over the whole length of the train and engine at the same time.

2. It should work on any length of train and have facilities in every car for applying the brakes.

3. It should act automatically in case of accident.

4. No possibility failure.

The Westinghouse brake very nearly fulfills all these requirements. The primary principle of this brake is that any reduction in train pipe pressure applies the brakes. The Westinghouse air brake was first applied as a straight air apparatus, in other words, the air was carried in the drum on the engine and none under the cars, the cars having cylinders only and no auxiliary drums. The brakes were applied by sending the air direct from the engine back to the cylinder thus putting the brakes on and then exhausting all the air from the train pipe to release. In 1876 the automatic feature was applied by which the auxiliaries were introduced under the cars and pressure carried in them, and what is called the plain triple valve was used. When it became necessary to apply air brakes to freight cars in the early 80's, it was found that the time necessary to drive the air the entire length of the train was so great that the brakes would be applied on the front end of the train so much sooner than the rear that the train would bunch itself to the extent of all the slack in the train, and then applying the brakes continuously from front to rear would cause such a reaction that it was dangerous to stock or even ordinary merchandise and in many instances broke the train in two. An attempt was then made to get a quick action on the triples by releasing the air at each triple direct to the atmosphere, overcoming the friction of the pipes, etc. In looking for this quick action, they discovered that not only could a quicker application be made, but that the air in surging through the pipes would pass over to the brake cylinder, and thus a greater pressure would be obtained.

The Westinghouse air brake of to-day consists of the following essential parts:

1. The pump which furnishes the air. It has two cylinders both the same size, viz: 9½ inches, the steam cylinder being immediately over the air cylinder, and one volume of air is pumped for one volume of steam. It uses steam at boiler pressure, and will raise the air pressure in the main reservoir from 0 to 90 pounds in about 80 seconds. This is located (fig. 4) generally on the right side of the boiler just ahead of the cab.

2. The main reservoir in which the compressed air is stored. For passenger engines its capacity is about 16,000 cubic inches, for freight engines 24,000 cubic inches.

3. The engineer's equalizing discharge valve, its functions being to regulate the flow of air from the main reservoir into the brake pipe for releasing brakes, and from the train pipe to the atmosphere for applying brakes. It is located (fig. 1) on the right side of the boiler under the throttle handle, so as to be handy for the engineer to use.

4. The train pipe, which goes from the main reservoir to the engineer's valve, and from there along under the train, supplying the apparatus under each car with air.

5. The auxiliary reservoir which might be called a local storer of air which is under each car and from which air goes to the brake cylinder to apply the brakes.

6. The brake cylinder which when its piston is forced out by the air from the auxiliary puts on the brakes.

7. The quick action triple valve which as its name implies, does three things: it admits air from the train pipe to the auxiliary reservoir, from the auxiliary reservoir to the brake cylinder, and from the brake cylinder to the atmosphere. The familiar whistle heard under a train as it comes to a stop is this triple valve allowing air to escape from the brake cylinder to the atmosphere. This is one of the most important parts of the air brake and one on which a great deal of time and money has been spent. In 1886 the existing air brake was declared useless, unless the triple valve be operated separately by electricity, and it was then that Geo. Westinghouse brought out the quick action triple valve.

8. The couplings which connect the train pipe from one car to the other.

9. The duplex air gauge which has a black and a red hand; the red hand showing the main reservoir pressure and the black hand showing train pipe pressure. The black hand tells the engineer how many pounds of air he has let out of the train pipe when he is making a stop. This gauge is located (fig. 4) next to the steam gauge on top of the boiler head, and is turned toward the engineer so he can see it easily.

10. The pump governor which starts or stops the pump automatically according as the pressure goes below 90 pounds, or above 90 pounds, in the main reservoir.

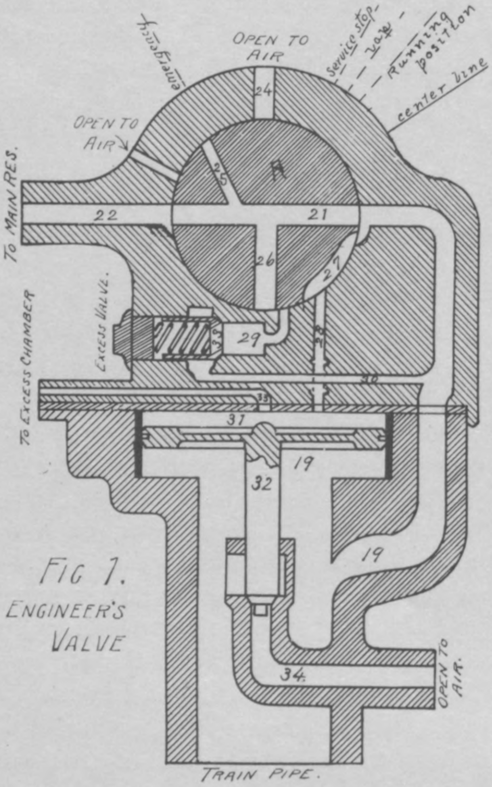


FIG 1.
ENGINEER'S
VALVE

Fig. 3 shows the general location of the apparatus under a passenger car. On a freight car the auxiliary reservoir, brake cylinder, and the triple valve, are all in one piece.

Fig. 4 shows the location of the apparatus on the engine.

Fig. 2 is a cross section of the triple valve.

Fig. 1 is a diagram of the the engineer's valve "A" being a rotary valve, and in the explanation of this valve further on, if a piece of paper be cut out and lined like the valve and a pin put through its center and the valve turned as the various operations are gone through, the explanation may be better understood.

To make the action of the brakes clear let us follow through the actual operation of the parts, and to take a practical case, suppose we have a train equipped with air brakes standing in the depot, and an engine has just been coupled on, and the main reservoir of the engine has been charged to its maximum capacity by the air pump before coupling on. The hose having been coupled together all the way through the train, the engineer moves the handle on the engineers valve from "running position" to "full release," (position shown in fig. 1) and the air rushes from the main reservoir through port 22 into valve "A" thence through passage 19 on into train pipe to the triple under each car. In each triple (fig. 2) the air goes through passage 1 thence through 2 by graduating spring 7 through 3, 3, into chamber 5 and from there into the auxiliary reservoir. Letting this amount of air into the train pipe has reduced the pressure in the main reservoir, and the pump governor opens up, letting the pump go to work until the air pressure is again at 90 pounds in the main reservoir. Passage 27 in engineers valve (fig. 1) also being open, air has flowed through passage 28 into chamber 31 and from there through passage 33 into excess chamber shown under the cab. Keeping piston 32 down and seating valve on its end, on passage 34. As soon as the train is charged the engineer moves valve "A" of engineer's valve (fig. 1) to running position. This brings port 26 in communication with port 29, communication between port 21 and passage 19 ceasing, air from main reservoir passes to the under side of "feed valve"

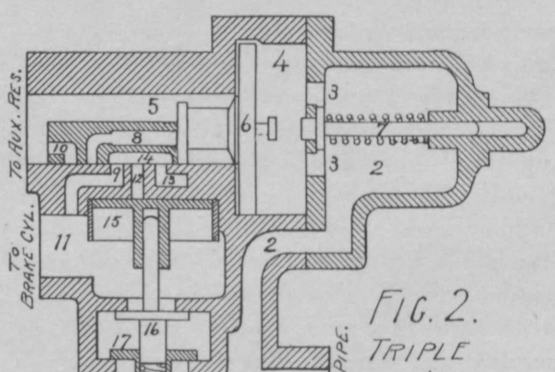


FIG. 2.
TRIPLE
VALVE.

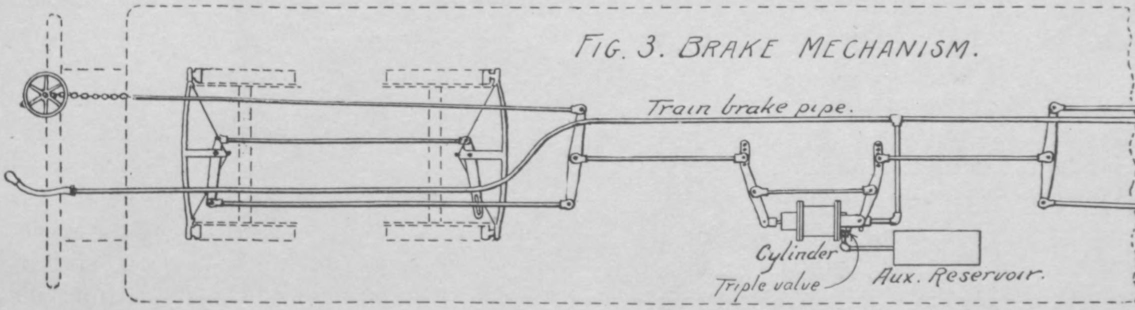


FIG. 3. BRAKE MECHANISM.

33 which is held on its seat by a graduating spring having a resistance of 20 pounds. The air pressure in the main reservoir reaching 90 pounds feed valve J3 is forced open and air is fed into the train pipe by passage 30 while train pipe pressure is kept 31, passage 19 being in communication with passage 28 by means of port 27 pressure above piston 32 being equal to pressure below. Suppose our train has left the station and is running along and a stop has to be made. The engineer first moves his brake handle to position marked on lap; communication ceases between port 26 and passage 29 and between port 27 and passage 28, port 21 is also blanked. From here he moves his valve to position marked service stop, this brings port 26 into direct communication with port 28 and port 25 in direct communication with the outside air, and air rushes by these passages from chamber 31 causing the pressure above piston 32 to be less than below it, therefore piston 32 raises the valve on its end raising also, communication between passage19 and 34 is established and air rushes from the train pipe to the atmosphere, and now let us see what is going on in the triple value, referring to (fig. 2). The air pressure having been reduced in passage 1 which is in direct communication with the train pipe, the pressure on back of piston 6 being greater than that on the front, it will move forward bringing port 8 in communication with passage 9. Air rushes from the auxiliary reservoir through passage 11 to brake cylinder pushing the piston in the brake cylinder out and pulling on the brakes, for ordinary applications the limit of the travel of the piston 6 is to graduating spring 7. Referring back to engineer's valve (fig. 1) after he let out, say 8 pounds, he pushes valve handle back to lap position, all ports being blanked, air ceases to flow from passage 28 and piston 32 gradually moves down as equilibrum is restored above and below it, shutting off communication between passages 19 and 34. Thus this piston mechanically measures the volume of air required to be discharged from the train pipe and limits the rate of its discharge when applying brakes for ordinary stop. It is of the greatest importance to perfect train braking that gradual discharge of air pressure from the train pipe should be made in applying brakes under ordinary conditions of service stops, and to gently close this exhaust in order to thoroughly equalize the remaining pressure in the train pipe. This the engineer's valve does, and piston 32 is called the equalizing discharge piston. Our train having come to a stop, the engineer moves his brake handle to full release chamber 31 is recharged and having 20 pounds pressure in the main reservoir in excess of train pressure ordinarily carried, so as to insure a prompt release, the air rushing through passage 19 and through train pipe to triple valve shoves piston 6 back to its first position, air flows on by to auxiliary reservoir and recharges it, port 9 is brought into communication with port 14, it in turn to exhaust port, and the air rushes from the brake cylinder through these passages to the atmosphere, and the spring behind the piston in the brake cylinder pushes it back to its normal position and the brakes are

released. Recharging the train pipe has somewhat reduced the pressure in the main reservoir and the red hand of the gauge shows less than 90 pounds. But the governor has opened up and the pump going to work soon restores pressure.

Suppose the train had to be suddenly stopped as in case of trying to avoid a collision. Then the emergency application is used. The engineer would throw his valve around to position marked emergency, bringing large port 26 in direct communication with the atmosphere, thus violently reducing the pressure in the train pipe and looking at the triple valve (fig. 2) piston 6 would go towards the right, striking graduating spring 7 and compressing it thus allowing it to travel still further, bringing port 10 in communication with port 9 and thus allowing

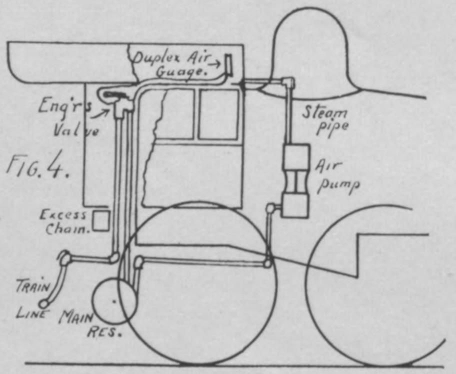


Fig. 4.

air to go into the brake cylinder, and port 8 also being in communication with port 12 air flows from auxiliary reservoir onto top of communication is established between passages piston 15 pushing it down, until it strikes the top of valve 16 and pushing valve 16 down 17 and 11 train pipe pressure also flowing from passage 1 raises the valve 18 and flows by passages 17 and 11 direct to brake cylinder until the pressure below valve 18 becomes less than above when valve 18 closes, and thus in the emergency application the quick action principle of the triple valve comes into play, and we not only get pressure from the auxiliary reservoir, but the train pipe itself helps supply air for the brake cylinder, and we get a pressure 20 per cent. greater on the brake cylinder. In the plain automatic brake all the air had to be discharged from the train pipe through the engine, and on a long train the brakes on the rear cars would not go on as quick by several seconds as the ones next to the engine, but with quick action brake, the air is discharged from the train pipe under each car and is utilized as well, and all brakes go on very nearly simultaneously. In an emergency stop piston 31 (fig. 1) does not play any part as the only object then is to get rid of the air in the train pipe as quickly as possible. The emergency application is only used is cases of danger as its application is very severe on the rolling stock and especially trying to passengers.

It is of great importance that the braking force applied to the wheels of a car, should be proportional to the weight of the car on the track under the wheels to which the brakes are applied. Practical experience has shown that a total brake force equal to 90 per cent. of the weight of the car on the wheels, on which the brakes are to act, is safe to figure on in passenger equipment and 70 per cent. for freight equipment.

Say we had a 72,000 pound passenger car with six wheel trucks, hence 72,000 pounds rests on twelve wheels, if we apply brakes to all the wheels we get a braking power of 64,800 pounds. But if we have six wheel trucks and only apply brakes to eight of the wheels and only 90 per cent. of 48,000 can be figured on, or a braking force of 43,000 pounds. Hence every wheel on a train should have a brake applied to it to get the greatest efficiency out of the apparatus. The Pennsylvania Railroad have commenced applying the brake to the leading trucks of their engines and can stop their trains in a shorter distance by about forty feet than formerly. For passenger cars a 14-inch brake cylinder is used, and for freight cars a 10-inch cylinder.

It is evident that the maximum power on the piston is obtained from the emergency application, and that the power from service application, used to make an ordinary station stop, while ample for all purposes, is very much below the maximum power of the brakes, and the result is a reducing to a minimum the number of slide flat wheels. The air train signaling apparatus is another application of compressed air that is almost universally adopted by the railroads. A second line of pipe runs under all the cars and is charged with air from the main reservoir through a reducing valve which reduces its pressure from 90 pounds to 25 pounds. A small whistle is located in the engine cab on the right side. If the conductor pulls the cord in the coach he opens a valve located in one end of the car immediately over the door, this allows the air to rush from the signal pipe, reducing the pressure therein, and destroying the equilibrium around a leather diaphragm located in a cylinder under the cab; this diaphragm rises lifting a valve up with it, opening a way for the air to rush from the cylinder to the whistle to blow it. Thus we see anything reducing the pressure in train pipe, such as train breaking in two, or a hose bursting, etc., causes the brakes to apply and the whistle to blow.

The following are some results of some tests made of the air brake at Buffalo, N. Y., in 1887. The test train consisted of fifty standard, Pennsylvania railroad, 60,000 capacity box cars. Total weight of train 2,000,000 pounds. Length of train 1,900 feet. Tests made on a grade descending 32.2 feet per mile:

First Test, (hand brake test).—Five brakemen at their posts, speed of train was twenty miles per hour. It ran 1,000 feet and it required forty-eight seconds time to come to a dead stop. At the same speed using air brake to make stop, the train ran 214 feet and it required twelve seconds to come to a dead stop.

Second Test.—Same train was run at a speed of forty miles per hour, and then broken in two it ran 414 feet before stopping and required thirteen seconds time. Four seconds was required to release brakes in all cases. The hand brake test as you see was made under very favorable conditions, for in actual practice the brakemen are generally found hugging the caboose stove, and when the engineer calls for brakes it requires quite a time for them to crawl over the train and get the brakes set.

The Westinghouse Air Brake company have instruction cars going over the country equipped with complete brake apparatus for about fifty cars, to instruct trainmen and others interested in air brakes. The men are required to attend the lectures given in the cars on the air brakes, and afterwards stand examination on them and pass a good grade before they are considered competent. The railroads have instruction plants at nearly all terminal points for trainmen, and some roads have an instructor whose sole duty is to teach the trainmen about the brakes.

Is Cupid a good Archer?
Though oft his arrow hisses
And all his aims seem fairly true,
He's always making Mrs.

—*University Courier.*

THE CHICAGO MAIN DRAINAGE CANAL.

BY W. C. MASON, '97.

The first effort to provide the City of Chicago with a sewage system was made in 1855, when the Illinois legislature passed a bill creating a Board of Sewerage Commissioners, to be appointed by the city councils. The full difficulties of the problem presented at that time can hardly be realized at the present day. The systematic sewage of cities, was then unknown in this country. The area which it was proposed to drain (what is now comprised between Chicago avenue and Twelfth street on the north and south, and Lake Michigan and Halstead street on the east and west was only twelve or fourteen feet above the lake at the higher points, and from this elevation the surface descended irregularly to a height of only three or four feet above the lake in the vicinity of the Chicago river.

The plan proposed by this Board of Sewerage Commissioners was to discharge all of the sewage into the Chicago river, and to keep the river water fresh, construct a canal 20 feet wide, 6 feet deep, through which water could be forced into the upper part of the south branch, along Sixteenth street. The finally constructed system differed considerably from the original plans. The more important changes were: The omission of the Sixteenth street canal and the discharge of the sewers directly into the lake. It should be noted that the construction of the great drainage channel will not correct this original error of emptying part of the sewers into the lake.

The first trouble did not arise from the sewers entering the lake, but from the accumulation of filth in the South Branch of the Chicago river.

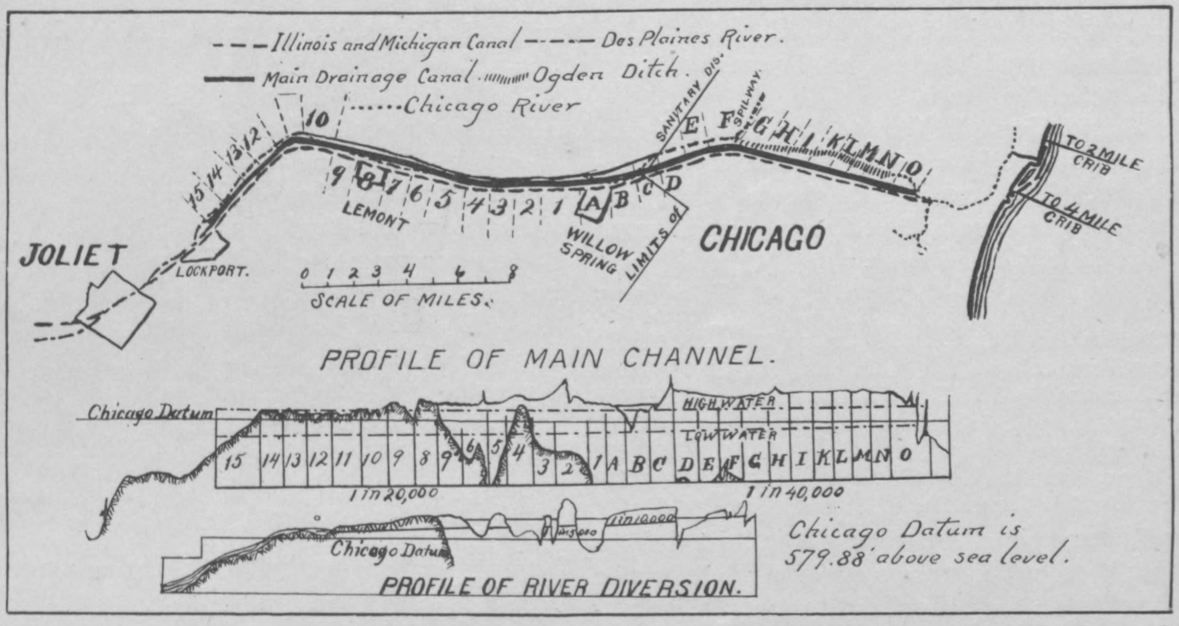
In the early winter of 1862, a combination of high water in the river and a southeast wind lowering the lake level, caused a very large amount of the river water to enter the lake, and the water supply was tainted with the filth.

In 1867 the Illinois & Michigan canal, with the city's aid, cut down the summit level so as to allow all the water for its use to be drawn from the lake, instead of taking part from the DesPlaines river as it had been doing. This relieved the South Branch, but the North Branch began to bother them, so it was decided to build a conduit along Fullerton avenue. This conduit did not do what it was intended to do; that is, to keep the North Branch clear of offensive sewage.

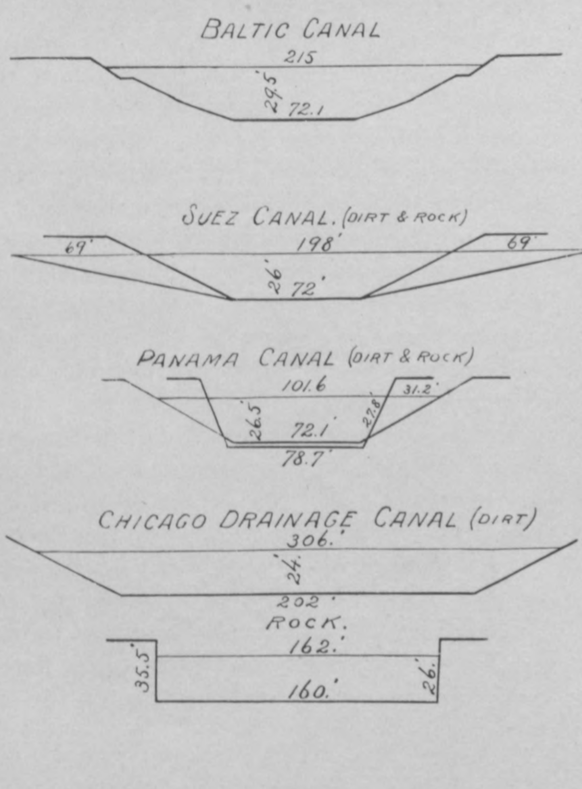
In 1889 the Illinois state legislature passed a bill (the Hurd bill) creating a metropolitan district, or the Sanitary District of Chicago. The trustees of this district, after a great delay, adopted the route along which the present canal is being constructed.

As will be seen from the accompanying map and profiles, the route selected lies on the south and east side of the DesPlaines river, and between the river and the old Illinois & Michigan canal. It crosses the bends of the river in a few places, and here the river channel is to be diverted by the excavation of a new channel. The principal works on, or connected with the canal, are: First, The spillway at the head of the river diversion (near Summit), which allows all water in excess of 300,000 cubic feet per minute, coming down the DesPlaines river, to flow east towards Chicago until the arrangements for carrying the entire flood waters of this stream through Joliet are perfected; second, the controlling works at the west end of the channel, to control the discharge of the water into the tail race, which is to deliver the outflow to the lower DesPlaines river at Lockport; and third, the water supply channel to deliver the necessary water from Lake Michigan to the main drainage channel.

The main drainage channel extends from the west fork of the South Branch of the Chicago river at Robey street, in the City of Chicago, to near Lockport, Will Co., and is divided into twenty-nine contract sections, each about one mile long. Beginning at Willow Springs, these sections are numbered from 1 to 15, going west, and from A to O (omitting J), going east. The dimensions of



the canal sections vary according to the material penetrated. The cross section of the earth sections from A to E inclusive, and for about 500 feet of section F, is 202 feet on the bottom, with side slopes 2 to 1. For the remainder of section F, and for sections G to O inclusive, the channel is 110 feet wide on the bottom, with side slopes of 2 to 1. The low water depth is 22 feet throughout.



The reason for this change of section is as follows: Throughout the rock sections and in those sections in which there is an excess of hard material, the section is designed for a flow of 600,000 cubic feet per minute, which means provision for a population of 3,000,000 people; while in soft earth sections, where dredges can work, the section is designed for a flow of only 300,000 cubic feet per minute, or provision for about the present population, it being intended to enlarge to the greater section when the increase of population demands it. The grade throughout the lettered sections is 0.0025 per cent., or 1 foot in 40,000 feet, and the bottom of the channel at Robey street is 24.448 feet below datum. [Datum is low water level in Lake Michigan in the year 1847, and is 579.88 feet above mean tide at New York City.] Sections 1 to 6 inclusive, are in earth and rock; the rock underlying the earth all along this portion of the channel. Here a prism 160 feet wide will be taken out of the bed rock and the side walls will be built to a height of 5 feet above datum. Sections 7 to 13, inclusive, are entirely in solid rock 160 feet wide at the bottom and 162 feet wide at the top. The grade in the rock section is 0.005 per cent., or 1 foot in 20,000 feet. The plan for the sections beyond 13 involves the construction of the controlling works.

The significance of these totals of earth and rock to be excavated is not easily realized, even by engineers. Compared with the excavation required in other great canals, these figures, given in round numbers, stand as follows:

	Total Excav. cubic yds.
*Panama Canal	200,000,000
Suez Canal	98,000,000
*Nicaragua Canal	70,000,000
North Sea and Baltic Canal	67,000,000
Manchester Ship Canal	48,000,000
Chicago Main Drainage Channel	40,000,000
Corinth Ship Canal	11,000,000

In comparing these one might be led to believe that it was not so very large after all; but let it be remembered that the principal object of this channel is for drainage, while these other canals are ship canals. Now, in order to make the drainage channel a ship canal (which is a secondary object) to connect Lake Michigan with the Illinois River and hence to the Mississippi, the channel must be continued for about 100 miles, which would make it almost equal in size to the Panama canal.

Wherever the top of the rock at the sides of the channel is below five feet above datum, a retaining wall of masonry, laid in cement mortar, is to be built. The material used in constructing the walls is to be stone taken from the channel.

All along the river diversion work, the specifications require a levee to be built between the river channel and drainage channel. This levee is to be built of spoil from the two channels and carried to a height well above that of the highest known high water mark. There are about nineteen miles of levee to be constructed.

[TO BE CONCLUDED NEXT MONTH.]

EMERGENCIES.

The second of the interesting lectures on the above subject by Dr. S. M. Rice was delivered before the Junior and Senior classes Friday, Jan. 24th, in the new Lecture Room on the third floor of the main building, formerly the Machine Design Room.

The Doctor first discussed the various simple methods of stopping hemorrhage, emphasizing the value of elevating the injured member and applying pressure, the simple grasp of the hand above the wound often being effective. For the common occurrence of bleeding at the nose he mentioned the application of cold water to the face and back of head, and pressure under the upper lip. In all cases of injury to the soft tissues the two great essentials are absolute cleanliness and the exclusion of the air. The special antiseptic gauze made for the use of physicians was strongly recommended for dressing such wounds.

For cases of broken limbs there is practically only one general rule to be followed till the doctor comes. This is to bind up the broken member with two sticks alongside to lessen the motion and consequent pain. The use of an umbrella or cane and pocket handkerchiefs for this purpose was suggested when nothing else is available.

For poisoned wounds such as snake and dog bites the most efficacious method of relief is suction applied immediately to the wound. Alcoholic stimulants are of some value, but not in the excess to which their use is sometimes carried in such cases. A very valuable remedy is ordinary household aqua ammonia. It may be inhaled and also applied directly to the wound. The speaker put especial stress upon one injunction in case of persons being bitten by a dog. This was, *don't kill the dog*, but catch him if possible, shut him up and watch him. If he shows no signs of being rabid, the patient will be in no danger and will be relieved of a great amount of anxiety. If the animal is unmistakably rabid the person bitten should be immediately sent to one of the Pasteur Institutes at New York, Chicago or San Francisco.

For all poisons either narcotic or irritant, the one universal remedy to be used as quickly as possible is an emetic. A mixture of mustard and hot water, or several table-spoonfuls of ipecac were recommended as being generally at hand.

Burns were classified as of three degrees: 1.

* Not yet constructed.

Redness of skin; 2. Blistering; 3. Destruction of skin and tissues. For the simpler cases the important means of relief are the exclusion of the air and application of soda or ordinary baking powder. The severer forms of burns generally result from the catching fire of clothing. The most efficient method of quenching the flames in such cases is to smother them with a heavy cloth or to lie down and roll over.

In cases of frost bite the danger of too abrupt change of temperature was mentioned.

When persons become or are found unconscious it is always important to distinguish the cause in order to apply remedies if serious or to withhold them if not so. In all cases the patient should be placed in a recumbent position, and if cold a *small amount* of stimulant administered. The most common cause of unconsciousness is syncope or fainting. Its cause is a lack of blood supply to the brain resulting from failure of the heart, injury, emotion, indigestion, hunger, or a number of other causes. It seldom results seriously, the person generally reviving in a few minutes, especially if carried into the open air.

The lecture, of which we have been compelled to give merely a brief outline, abounded in suggestions of much value and was received with the most careful attention. In another lecture to be given in the near future the subjects of sunstroke, drowning, suffocation and electric shock, will be taken up.

SIGMA NU'S AT HOME.

The Sigma Nu's gave a progressive cinch party at their rooms in the Rose Dispensary building Friday, Jan. 22d. Five tables played. After light refreshments a few impromptu dances were indulged in, which added to the features of the evening. The rooms were tastefully decorated with Fraternity colors.

"OPERATIC MINSTRELS."

The initial performance of the Johnsing Family, every member of which is an artist in some line or other, was given on the evening of January 30th, at the residence of Mr. and Mrs. Allyn Adams, 410 North Center street. The audience was composed of a select party of friends, including several members of the Institute faculty. Very few of those present had any idea of the nature of the exhibition to which they had been invited until the curtain rose, revealing the entire company seated in a half circle, all attired in white bloomers, white coats with large puff sleeves, black wigs and faces. Then followed in rapid succession short songs, stories with a local point that was sometimes pretty sharp, jokes and so on in regulation minstrel style. The following is the dramatis personæ and also the notices on the last leaf of the program:

DRAMATIS PERSONÆ.

Interlocutor	George Washington Hellweg Johnsing
Bones	Remus Lansden Johnsing Rastus Ford Johnsing
Tambourines	Peter Boudinot Johnsing Noah Flickinger Johnsing
Intermediates	Jasper Wiley Johnsing Sambo Krebs Johnsing
Orchestra—	
1st Flute*	Abe Liggett Johnsing
1st Mandolin*	Nicodemus Fletcher Johnsing
1st Trombone*	Moses Lufkin Johnsing
Musical Director	Noah Flickinger Johnsing
Stage Manager	Peter Boudinot Johnsing
Stage Carpenter	Rastus Ford Johnsing
Business Manager	Remus Lansden Johnsing
Advance Agent	Same
Advertising Agent	Same
Designer of Costumes	Same
Master of Properties	Sambo Krebs Johnsing
Scene Shifter	Uncle Allyn Adams Johnsing

*No seconds.

All of the music is used for the first time in this city. Doubters will please call at the box office for proof.

—

Complexions designed by the Johnsing family—also used for the first time in this city. Patent applied for.

—

The beautiful and unique stage settings (seen for the first time in this or any other city) were designed by the designer and set by the setter, under the supervision of the supervisor.

—

The Symphonic Poem was composed especially for this occasion by Herr Professor Noah Flickinger Johnsing, and dedicated to his teacher, the great Richard Wagner. Probably the last performance of this wonderful work in this country.

—

The self-adjusting double-back action noiseless ball-bearing and greaseless scene shifting apparatus used by the Johnsing family is the invention of the Faculty of the Rose Polytechnic Institute, under the direction of Prof. M. A. Howe, C. E.

GRADUATING THESES.

The subjects for the theses of the Senior Class have all been decided upon, with the exception of some minor details. Following is a complete list of the same:

ELECTRICAL.

1. Conductivity of oxide films, as used in laminated armatures and transformers. F. T. Green, C. M. Ridgely.

2. The relative economy of the Rheostat and series parallel controller. Louisville Street railway Co. W. L. Decker, F. E. Smith, F. G. Hunt, H. T. Liggett.

3. Investigations upon two phase alternating current motors and transformers, various types. Design of two phase motor and transformer. G. E. Wells, R. W. Beebe.

MECHANICAL.

4. Test of 60 h. p. engine (Brown type) and boilers, Rose Polytechnic shops. L. Sanford, U. U. Carr, B. D. O'Brien.

5. Locomotive test, Peoria Div. Van. Line. B. F. Failey, James Farrington, Richard Meriwether.

6. Complete test of 30 h. p. White & Middleton gas engine and efficiency test of elevator operated by motor. Indianapolis Soldiers and Sailors Monument. O. G. Rice, O. E. McMeans.

7. Test of strength of drawn steel tubing for bicycles. W. J. Klinger.

8. Construction of a dynamometer for bicycles and tests of same. P. W. Klinger.

CIVIL ENGINEERIVG.

9. Plans and specifications for a steel viaduct over the E. & T. H. tracks at Tenth and Ohio streets, Terre Haute. J. M. Van Auken, C. H. Holderman.

10. Design for a highway bridge across the Wabash river, foot of Main street, Terre Haute. Fixed part, H. H. Meadows; draw part, H. J. McDargh.

11. Hydraulics. Flow of water through orifices, under different heads. W. R. Sanborn, F. F. Sinks.

CHEMISTRY.

12. Derivation of cis-campholytic acid. E. B. Harris.

13. Derivatives of neighboring metaxylilic acid. W. E. Burk.

14. A study of the Terre Haute gas plant. Edward Walser.

15. Determination of sulphur in coals, for purposes of establishing a standard method. I. M. L. Werk.

CAMERA CLUB NOTES.

Meyer '97 has a new 5x7 Premo Senior that fairly makes the other members turn green with envy when they drop in to look at it.

Brachmann '98 is having some noteworthy success. His "Taking 2,000 volts" should be seen to be appreciated.

Ridgely '96 sent his box to the manufacturer some two weeks ago to have some repairs made. Since then he has seen more things to take shots at than in all his previous experience.

Newbold '97 has succeeded in getting some very good double pictures by the method described in the last issue of THE TECHNIC.

OPERA HOUSE ATTRACTIONS.

February 17—"Wang."
February 19—Sinbad.
February 22—Oliver Byron.
February 25—Lost in New York.
February 29—Kellar.
February 18—Negotiations are pending for return visit of Thos. Q. Seabrooke as The Speculator.

Ask Werk, '96, how to cook craw-fish.

Have Sinks, '96, tell you the sequel to his "Atlanta" story.

Prof. Hathaway will shortly publish a text-book on quaternions.

"Short" Sanford can give pointers on handling a fire hose. Prof. B. on dodging one.

Prof. H.'s whiskers are now of sufficient length to be the sport of the gentle breezes.

Sinks '96 was called to his home at Troy, O. on Sunday February 8, by the serious illness of his father.

Ford, '98, says that you prepare sodium by heating sodium carbonate with carbon and electricity.

The class in Spanish are using Smith's Spanish grammar, which contains not a word of English from cover to cover.

Prof. N., assigning subjects for chemistry papers—"Mr. Theobald, you may take arsenic two weeks from to-day."

Prof. K.—"Now give us a practical example."

Junior—"Well, take any solid body, a pitcher of water, for instance."

Translation from Wilhelm Tell—The Swiss are fit for nothing except to milk the goats and lazily to bum around on the mountains.

Prof. K.—"I cannot measure 100° with a 50° thermometer."

J. B. H.—"Not if you use it twice?"

The third edition of Prof. M. A. Howe's work on Retaining Walls will soon be issued from the press. In addition to being thoroughly revised it will contain forty pages on the subject of foundations.

"In the case of some estates in the older countries a laborer expects his regular wages as long as he lives and a pension afterwards."—Prof. W.

A Freshman was overheard modestly inquiring of a Junior the other day as to whether mathematics was just the same in German as in English.

If the Orchestra continues to adjourn its rehearsals in favor of attractions at the theatre, the promised annual concert will be an uncertain quantity.

President Mees, assisted by Professor Gray, lectured before the Engineers' and Architects' Club of Louisville, Ky., on February 13, on the subject of "Vibrations."

The President's "absence book" contains the following entry: "Jan. 23–25, C. M. Ridgely; cause, cutting teeth." May we be allowed to humbly suggest Castoria.

W. J. Klinger has been suffering from the effects of a slight attack of pneumonia. He was confined to his room for several days but is, fortunately, recovering nicely.

Prof. G.—"You want to have these things at your finger ends even if you don't have them in your head." Query—Did he really mean to encourage cribbing?

The discussion at the club breakfast table had turned upon Thos. Q. Seabrooke, when a Freshman remarked, with a knowing air, "I think he is at his best in melo-comedy."

Some enterprising Freshmen have been conducting a series of tests to determine the ultimate tensile strength of a boarding house ginger snap. The maximum stress so far found is two chairs, three pairs of shoes, Chauvenet's geometry and Chas. Smith's algebra.

The most successful photographs so far obtained here by the Röntgen method have been by using ordinary incandescent lamp bulbs as tubes in which to produce the discharge.

The class of '96, has, so far, established the record for largest enrollment in every year of the course. The figures stand thus: Freshman, 71; Sophomore, 42; Junior, 32; Senior, 28.

Overheard in the Soph. German class—"Switzerland is about twenty miles long." "The Danube flows into the North Sea." "The Yangtsi Kiang is the longest river in America."

Pres. Mees has placed the large roll of paper which he received as a Christmas present from the Seniors, in the Phys. Lab. and above it is displayed the notice, "Exclusively for class of '96."

The Gym. class is flourishing. The enrollment is at present about 25, and excellent work is being done. There are some who should be in the class, that have not entered as yet. Somebody jog them up a little.

Instructor Harris and O. G. Rice indulged in a walking match one evening recently, under the special condition that the contestant who failed to keep step should be declared loser. It was step and step for some distance but Harris' giant stride finally prevailed.

One of the chemists ran across a delicate little compound, bearing the name of methylisopropyltetramethylenedicaronsaureanhydrid. Experiments upon it are to be deferred until the new Lab. is finished, as in the present limited quarters there is no room for the name without opening the window.

An interesting and hitherto entirely unrecognized law in physics was discovered by a group of three experimenters in the Phys. Lab. some few days ago. After three hours of careful observation and calculation they proved, to their own satisfaction, at least, that all pendulums vibrate with the same period, irrespective of their length.

There is one member of '99 that certainly believes in having things ornamental as well as useful. Having suffered a slight abrasion of the skin directly on the end of his nose, and desiring to apply the usual household remedy, court plaster, he selected black as the color and cut the piece into a star of very neat design. When placed symmetrically over the wound it was about as prominent as the roof on the new Lab.

Prof. G. was detained in the laboratory until some little while after the noon hour. Coming down stairs, he found everything locked up and the janitor gone. "Well," he muttered, "that's awkward. Hat and overcoat on the other side of that door. Have to get a pair of steps, I guess, and go over the top." The ladder was found and placed in position, when a student happened along and volunteered to perform the necessary athletic feat.

Harris, '96, is conducting some special experiments upon the manufacture and purification of citric acid, with especial reference to the industry of lemon growing. He has received many inquiries and catalogues from lemon producers and agricultural boards of the Pacific states. His first attempt with a box of lemons resulted in about a double handful of shining crystals of Epsom salts. An interested fellow-student innocently asked if he was going to take it all at one dose.

A number of the students and members of the faculty witnessed the exercises in honor of the Columbian Liberty Bell, which passed through the city, Tuesday, January 28th, enroute from Atlanta to Chicago. The opportunity of hearing that "grand old man," Col. Thompson, is always welcomed and especially was it so when his eloquence was moved by such an inspiring theme. The members of the Camera club took some fine pictures of the bell and its special car while it stood in the yard.

The thesis subject which P. W. Klinger has chosen is a capital example of the combination of business and pleasure. An exhaustive series of tests of a bicycle dynamometer necessarily implies a great deal of riding, and Pete is never entirely happy unless he is spinning over the road at a hot clip. Some idea of the enthusiasm with which he is working at his subject may be gained from the fact that he dreamed of reading an article in the *Bearings* describing a new form of bicycle dynamometer and woke up mad enough to fight.

A Freshman was busily engaged in the woodshop, making some repairs on a chair with abnormally long legs commonly known as a high chair, belonging to one of the members of the faculty. A fellow wood butcher approached and remarked, "Hello, what have we here?" "Oh!" was the reply, "that is a wicker chair." "Why," queried the first, "I don't see where the wicker comes in." "Well," said the other without looking up from his work; "you see it is only a sham wicker or in other words a Wickersham chair."

One evening not long since when the moon and Jupiter were in conjunction, the telescope at the Midway Observatory was aimed in the direction of the interesting pair, as it happened at that instant, at Jupiter. A Freshman visitor asked the privilege of looking through it. This was granted and the astronomer on duty remarked, "You will notice the four little moons all in a straight line." "Yes," said Freshie, "but I never knew before that the Moon had four other little moons around it."

Here sits a dull, old sleepy head,
Wishes he was at home in bed,
But the Prof. called Hathaway
Gives his lecture, so they say.
He often speaks of cross ratio,
But what he means I do not know.

This plaintive wail, to the tune of "Don't be Cross," was written by a certain Sophomore last week in Prof. Hathaway's room "on the morning after the night before." He fell asleep at this point, but intimates that we may expect a chorus as soon as the inspiration moves him.

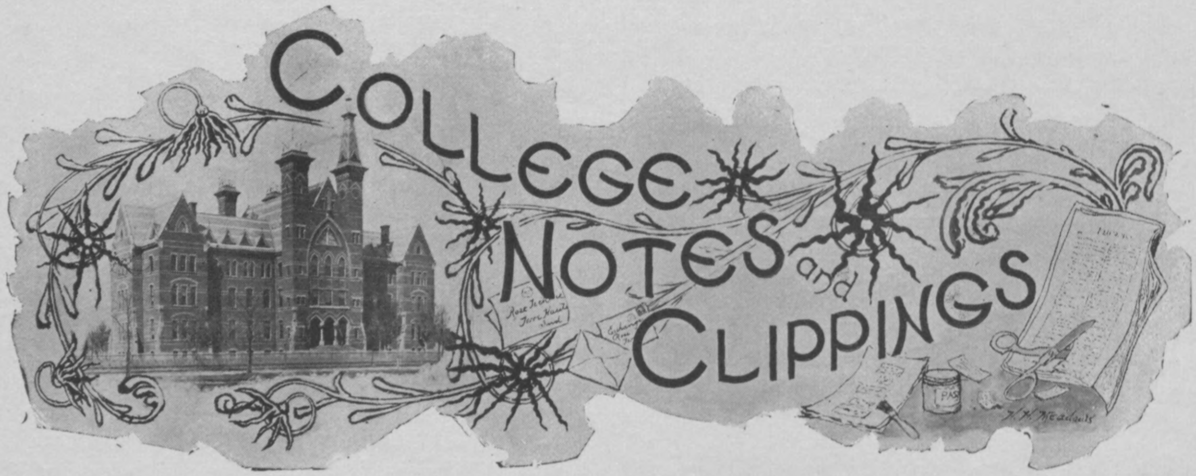
Y. M. C. A. JOTTINGS.

Mr. W. P. Smith spoke on the topic "The Greatest Pleasure" on Wednesday, February 12.

Prof. Hathaway gave an interesting talk on the subject of "Faith as an Element of Character" before the regular meeting of January 29.

The following periodicals may be found on file at the Association Room 927 north Seventh street. Terre Haute Gazette, Terre Haute Express, Daily Tribune, Saturday Mail, Review of Reviews, Electrical World, Young Men's Era, and American Wheelman. The room is open every evening to all students.

× Midway. House where we roomed.



The whole number of Harvard graduates is 19,335; of Yale, 16,737.

During the past year 12,880 volumes have been added to the Cornell University library.

The trustees of the State College at Lexington, Ky., have prohibited football as a college sport.—*Unit.*

The Senior law students at Wisconsin will wear full beards in place of caps and gowns.—*Butler Collegian.*

There now remain only two colleges in the west which do not admit women—Wabash and Illinois.—*Ex.*

In the present House of Representatives there are 173 college-bred men, against 183 who are not college graduates.—*Ex.*

Oxford University, so-called, consists of twenty-two colleges, has an enrollment of 12,000 and an annual income of $6,000,000.

On account of some trouble this year, the University of Michigan Junior hop is to be held in Toledo instead of at Ann Arbor.

The "Five Minute Sketches from College Life," which are appearing in the *Purdue Exponent*, are excellent, abounding in genuine college spirit and humor.

Professor Coulter received the following letter of recommendation recently: "If this is the kind of young man you want, I think he will suit you."—*Purdue Exponent.*

Ella S. Leonard, in the *Vassar Miscellany* for January, writes in a realistic way of "Women and the Making of Newspapers," giving pointed illustrations from her own experience.

The *McMicken Review* must surely possess an improved double cylinder, rapid perfecting printing directly from the roll, poetry machine. All its local items are served up in verse.

Professor—How would you punctuate the sentence, "Ethel, a girl of eighteen years, walked down Main street?"

Eager Freshman—I'd make a dash after Ethel. —*Ex.*

A movement is on foot among some of the alumni of the University of Pennsylvania to establish a fellowship in anatomy as a memorial of Dr. Joseph Leidy. The proposed endowment is $30,000.

Kneading bread and making beds will no longer be considered necessary for the course of B. A. at Wellesley. To meet the resulting extra expense, there will be an additional fifty dollars on the tuition.—*Ex.*

We can always expect something good from the *Earlhamite.* In the current number, T. Ray White, under the title "After Christianity—what?" draws some conclusions that are in harmony with the spirit of the times which in religious thought as in other planes is expressed by the one word "progress."

The faculty of Boston University has decided to allow work on the college paper to count for English in the regular course.—*Ex.*

The University of Michigan has been forbidden its usual Eastern base ball trip in the spring, although a game with Yale has been arranged. Charges of professionalism had something to do with the faculty's decision.—*Ex.*

One prolific source of college comment and gossip, and at times of more sober discussion, is entirely unknown in Rose life. We refer to the daily chapel exercises in vogue in the great majority of institutions of learning.

The college Greek-letter fraternities in the United States have a membership of 100,000, with some 650 active and 350 inactive chapters. They own seventy houses or halls in various college towns and cities.—*Harvard Crimson.*

The *Georgia Tech*, which was discontinued during the progress of the Cotton States and International Exposition, comes to us once more in a special cover design for January. We are glad to know that its silence was from no more serious cause than a midwinter nap.

At last one of the pleas of the *Exponent* has seen an establishment, and although the "Gym" is not stupendous, either in size, elegance or equipment, it is a fine beginning, is well patronized, and has a promising future. Classes were started last week and rules issued.—*Purdue Exponent.*

The University of Paris has over 7,000 students, and in this, as in other universities in France, there are no classes, no athletics, no commencement day, no college periodicals, no glee clubs and no fraternities.—*Knox Coup D'Etat.*

A pension fund is to be established at Cornell for the benefit of the professors who have retired from teaching on account of age. It is proposed that the maximum pension be $200, and the limit of active service be fixed at sixty-five years.

A communication in the *Wesleyan Argus* of Jan. 14, on "The Examination Question" strikes a blow from the shoulder at the practice of "cramming." While it is undeniably contrary to all the modern ideas of education or of the laws of sound, intellectual development, to say nothing of good health, it will remain, perhaps, as long as the examination system is retained.

President Mendenhall, of Worcester Polytechnic Institute, has arranged a course of lectures to be given before all the students of the Institute. A partial list of the lectures, as given by the W. P. I., is as follows: J. A. Brashear, Pittsburg, Pa.; E. L. Corthell, New York; B. E. Ferns, Washington, D. C.; Rev. Dr. Gunnison, Worcester; Mr. William Kent, Editor *Engineering News*, New York Prof. C. F. Mabers, Cleveland, O,; Rev. Dr. Merriman, Worcester; Prof. E. S. Morse, Salem; Col. Henry G. Prout, Editor *Railway Gazette*; and Prof, E. Harlow Russell, Worcester.